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THE ACCOUNTING REVIEW

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A FORUM ON FINANCIAL REPORTING

MARY E. BARTH

Fair Value Accounting: Evidence from Investment Securities and the Market Valuation of Banks

THOMAS WILLIAM SCOTT

Incentives and Disincentives for Financial Disclosure: Voluntary Disclosure of Defined Benefit Pension Plan Information by Canadian Firms

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Auditor Switching and Conservatism

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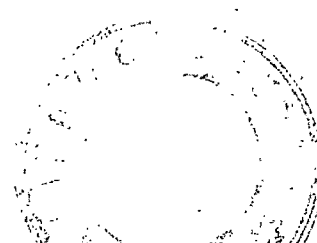
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Fair Value Accounting: Evidence from Investment Securities and the Market Valuation of Banks

Mary E. Barth
Harvard University

SYNOPSIS AND INTRODUCTION: This study investigates how disclosed fair value estimates of banks' investment securities and securities gains and losses based on those estimates are reflected in share prices in comparison with historical costs. Fair value securities gains and losses are calculable because banks also disclose realized securities gains and losses. Thus, banks' investment securities provide an opportunity to examine two measurement methods, historical cost and fair value, for both an asset and its related earnings component.

Previous research does not provide strong evidence on value-relevance of asset fair value estimates. Errors in estimating the fair values is the primary explanation for this unexpected finding. Another explanation relates to cross-sectional differences in sample firms, e.g., industry membership. This study examines disclosed fair values of investment securities that can be considered more reliable than previously-studied fair value disclosures. Moreover, the sample firms here belong to one industry, banking. This study also investigates the Barth et al. (1990) suggestion that fair value securities gains and losses are value-relevant.

By examining how share prices reflect historical costs and fair values, evidence is provided on the measures' relevance and reliability. Because these are the FASB's two principal criteria for choosing among accounting alternatives [Statement of Financial Accounting Concepts (SFAC) No. 2, FASB 1980], the evidence

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can inform the FASB's deliberations on using fair value accounting for investment securities, to the extent the disclosed fair value estimates would be used to measure investment securities under fair value accounting.

Share prices for a sample of banks are explained using investment securities historical costs and fair value estimates together with the book value of equity before investment securities. Similarly, bank stock returns are explained using securities gains and losses based on historical costs and on fair values together with earnings before securities gains and losses. The analyses provide evidence on the two methods' incremental and relative explanatory power, and relative measurement error.

The findings indicate that fair value estimates of investment securities provide significant explanatory power beyond that provided by historical costs. Strikingly, historical costs provide *no* significant explanatory power incremental to fair values. Using a measurement error model, investment securities' fair values are found to have less measurement error than historical costs vis-à-vis the amount reflected in share prices. The findings for securities gains and losses are different. The significance of any incremental explanatory power for fair values beyond historical costs depends on the specification of the estimating equation. In some specifications, fair value securities gains and losses have no significant incremental explanatory power, but historical costs always provide explanatory power incremental to fair values. The findings based on a measurement error model indicate that fair value securities gains and losses also have more measurement error than historical costs. Thus, although fair value estimates of investment securities appear reliable and relevant to investors in valuing bank equity, fair value securities gains and losses do not.

One interpretation for these findings is that although estimation error in the disclosed fair values is small enough that investment securities' fair values appear value-relevant, when two annual fair value estimates are used to calculate securities gains and losses, the effect of the combined estimation errors renders securities gains and losses value-irrelevant. Another plausible interpretation is that securities gains and losses might be offset by unrecognized correlated gains and losses on other assets and liabilities. Why this affects securities gains and losses but not investment securities is an unresolved question. Evidence from supplemental analyses gives more credence to the first interpretation than to the second.

Key Words: *Fair value accounting, Banks, Security prices, Financial reporting.*

Data Availability: *Inquiries regarding data availability should be submitted to the author with a brief description of its intended uses.*

THIS article proceeds as follows. Section I describes the fair value accounting debate, particularly as it relates to investment securities, and section II reviews related prior research. Section III sets forth the estimation equations and section IV presents the related empirical findings. Section V presents results from supplemental analyses that explore the plausibility of the two primary competing interpretations for the findings reported in section IV. Section VI offers a summary and conclusion.

I. Fair Value Accounting Debate and Investment Securities

Fair Value Accounting

Fair value, mark-to-market, market value-based, and market value accounting often are used as synonyms. Advocates of fair value accounting believe that fair values provide more relevant measures of assets, liabilities, and earnings than historical costs provide. Former Securities and Exchange Commission (SEC) Chairman Breeden advocated a move to fair value accounting for financial institutions as well as all publicly-held companies, and stated his belief that market-based information is the most relevant financial data attribute (testimony before the Committee on Banking, Housing, and Urban Affairs, U.S. Senate, September 10, 1990). Recently-issued Statement of Financial Accounting Standards (SFAS) No. 107 requires disclosure of fair values for all financial instruments, suggesting the FASB also believes the information is relevant to financial statement users.¹ However, few other FASB standards require disclosure or recognition of financial statement amounts based on fair values.

Critics of fair value accounting point to the reduced reliability of fair value estimates relative to historical costs. Their argument suggests that investors would be reluctant to base valuation decisions on the more subjective fair value estimates.² Bank managers and regulators are among the critics. Although Generally Accepted Accounting Principles (GAAP) are not used explicitly in regulating banks, by requiring that regulatory accounting principles be no less conservative than GAAP, the FDIC Improvement Act of 1991 moved toward linking GAAP and bank regulation more closely.

Investment Securities

Banks' investment securities comprise primarily government-issued debt securities (i.e., Federal, state, and local governments, and their agencies) that banks have the ability and intent to hold to maturity. GAAP requires recognizing investment securities at cost, adjusted by any unamortized premium or discount, and gains and losses are recognized only when realized. The basis for this accounting is that no adjustment to fair value is necessary because the intent to hold to maturity renders interim market fluctuations irrelevant (AICPA 1990).³

Banks have been disclosing investment securities fair value estimates for many years, suggesting small data-gathering costs for fair value accounting for this asset. Fair value estimates for actively-traded debt securities, e.g., many U.S. Treasury securities, are available from established markets or broker quotes. However, estimates for the approximately 1.3 million municipal bond issues held by banks are obtained using a variety of valuation techniques such as matrix pricing and fundamental analysis. During this study's sample period, on average 50 to 73 percent of the sample banks' investment securities portfolio was comprised of other than U.S. Treasury securities. Thus, although relatively reliable compared with other

¹In SFAS 107, the FASB adopts the term "fair value" because not all assets and liabilities have values obtainable from markets.

²Other concerns are: (1) the presumed increased volatility associated with fair values would cause banks to violate regulatory net worth requirements "too often," disrupting the banking system; (2) fair values do not help in estimating future cash flows of securities held to maturity; and (3) banks will alter investment decisions if required to recognize assets at fair values. These issues are beyond the scope of this study. See, e.g., Barth et al. (1993), Beaver et al. (1992), Bernard et al. (1992), Jones et al. (1991), and White (1991).

³Banks segregate non-investment securities into (1) trading securities, which the bank intends to trade actively and recognizes at fair value; and (2) securities held for sale, recognized at the lower of cost or market. Typically these two categories are a small fraction of bank assets.

bank assets and liabilities, estimates of investment securities' fair values contain estimation error, and are not equivalent to values obtained from established and thickly traded markets.⁴

Investment securities comprise a large bank asset, and the difference between historical cost and fair value estimates can be substantial. For this study's sample banks, for example, investment securities' historical cost (fair values) on average across the sample years range from 16.5 (14.9) percent of total assets, to 20.9 (21.0) percent. The average difference between historical cost and fair values ranges up to 36.5 (56.8) percent of the book (market) value of equity.

Primarily for these reasons, banks' investment securities are a focus of the fair value accounting debate. To resolve identified problems with accounting for investment securities, the FASB has considered several alternatives: (1) retain historical cost accounting; (2) recognize the asset at estimated fair value and recognize unrealized gains and losses either (a) in earnings, or (b) directly in equity; (3) recognize investment securities and some related liabilities at estimated fair value to avoid unrecognized offsetting gains and losses; and (4) redefining the term investment securities to include only those securities actually held to maturity. Evidence is provided on the first three alternatives by (1) comparing the incremental explanatory power of historical costs and fair values, (2) investigating the value-relevance of unrealized securities gains and losses in an earnings context, and (3) investigating the effects of unrecognized offsetting gains and losses. As for the fourth alternative, adopted by the FASB in SFAS 115 (1993) "Accounting for Certain Investments in Debt and Equity Securities," realized securities gains and losses are *prima facie* evidence that the securities are not all held to maturity. SFAS 115 does not resolve all of the identified financial reporting issues for debt securities, but the FASB believes it improves current practice (SFAS 115 ¶28).

II. Relation to Existing Research

Fair Value Disclosures

Prior research on SFAS 33 (FASB 1979) (and SEC Accounting Series Release No. 190) current and replacement cost, and SFAS 19 (FASB 1977) oil and gas valuation disclosures typically compared fair value estimates to historical costs, but reported mixed results regarding value-relevance of fair values.

In the case of SFAS 33 disclosures, Beaver and Landsman (1983) find that historical cost earnings dominate current and replacement cost measures. Several other studies report similar findings (e.g., Beaver et al. 1982; *Journal of Accounting and Economics* August 1980; *Financial Analysts Journal* March/April 1983; Beaver and Ryan 1985; Bernard and Ruland 1987). However, Bublitz et al. (1985), Murdoch (1986), and Haw and Lustgarten (1988) find that the fair value disclosures have incremental explanatory power, and attribute the difference in findings to model specification, including correlated omitted variables and effects of measurement error, which is especially important for SFAS 33 disclosures. Other studies attribute the lack of significant findings to cross-sectional variation among sample firms (e.g., Hopwood and Schaefer 1989; Lobo and Song 1989). Because this study's sample firms belong

⁴The Bank Administration Institute (1990) survey of bank valuation practices states:

... the existence of dealer prices does not necessarily mean that prices are verifiable with a high degree of confidence. Many banks supplement dealer prices with values computed through the use of mathematical models which employ assumptions about interest rates, volatility, credit risk, and other factors. As a consequence, judgment frequently plays a role in the determination of fair values even where dealer quotes and mathematical models are available.

to one industry with fairly homogeneous production and investment functions, banking, these cross-sectional variation issues should not arise.

Similarly, studies investigating SFAS 19 oil and gas valuation disclosures present mixed findings. For example, Harris and Ohlson (1987) and Magliolo (1986) find that oil and gas book values are significant, and generally more so than the disclosed valuation amounts, in explaining the market value of oil and gas properties as inferred from the market value of equity. However, Bell (1983) finds a positive stock return reaction to initial SFAS 19 disclosures.⁵

Other studies specifically investigating banks and thrifts also report mixed findings about the informativeness of disclosures that purportedly provide information about asset fair values. For example, Beaver et al. (1989) find that disclosures about nonperforming loans (default risk) and loan maturity variables (interest rate risk) that relate to estimating the fair value of banks' loan portfolios help explain cross-sectional variation in banks' market-to-book ratios. However, Barth et al. (1991) investigate similar disclosures for thrifts (scheduled items and repricing data) and find that only scheduled items (an indication of default risk) are incrementally informative.

Component of Bank Earnings

Several security-price research studies (e.g., Lipe 1986; Ohlson and Penman 1991; Barth et al. 1992) examine the incremental information content of earnings components. They investigate whether particular components of earnings have different earnings multiples because, for example, a higher earnings multiple is expected for components that are largely "permanent" rather than "transitory." In this study, earnings before securities gains and losses is expected to be more permanent than securities gains and losses, and thus is expected to have a larger estimated coefficient.

Barth et al. (1990, hereafter BBW) and Warfield and Linsmeier (1992, hereafter WL) examine the realized securities gains and losses component of bank earnings. BBW find that the multiple on earnings before securities gains and losses is positive and differs significantly from zero in each year examined, yet the multiple on realized securities gains and losses generally is insignificantly different from zero. BBW suggest that the market might not value realized securities gains and losses because they are transitory, they lack timeliness, and management is able to manipulate them.⁶

WL extend BBW by investigating the effect of a bank's tax status on realized securities gains and losses' coefficient. Because securities gains and losses are taxed when realized, WL posit tax motivations to explain banks' gain or loss realization timing decision. They find that a bank's tax status and whether the amount realized is a gain or loss helps explain the association between earnings before securities gains and losses, realized securities gains and losses, and stock returns. The tax motivations WL posit do not apply to total fair value securities gains and losses, only to the realized portion.

⁵The inconsistent findings of previous research do not appear attributable to whether an asset-based or earnings-based equation is estimated. The SFAS 33 studies all use earnings-based equations, whereas the SFAS 19 studies primarily use asset-based equations.

⁶For a small sample of banks pooled temporally and cross-sectionally, Jones et al. (1991) find that earnings including fair value securities gains and losses is more highly correlated with year-end market value of equity than earnings including historical cost securities gains and losses. This study differs from Jones et al. in many ways, including using a larger sample over more years, and reporting statistics that take account of potential residual dependence.

III. Empirical Relations

The empirical relations estimated in this study are based on (1) a valuation model where the market value of equity equals a firm's assets minus its liabilities to investigate investment securities, and (2) an earnings capitalization model to investigate securities gains and losses. Adopting these two perspectives admits the possibility that the same measurement method might not be value-relevant under both, e.g., because of measurement error.⁷ Although for most accounting methods the statements of income and financial position articulate, GAAP permits recognizing changes in assets directly in equity (SFAC 5, ¶30-51, FASB 1984).⁸

Investment Securities

The incremental explanatory power of investment securities fair value estimates is assessed by estimating the relation between bank market value of equity and net assets, partitioned into investment securities and net assets before investment securities.⁹ To determine whether fair values provide explanatory power incremental to historical costs, both are included as explanatory variables. This cross-sectional estimation assumes the relation is constant across firms, which likely is reasonable for banks that are largely homogeneous with respect to asset and liability structure and nature of operations. However, potentially relevant differences among banks include investment securities fair value estimation skills and tax status; whether these differences violate the homogeneity assumption is explored below.

The estimation equations are:

$$MVE_{it} = \alpha_{0t} + \alpha_{1t}BVE_{Bit} + \alpha_{2t}BINV_{it} + \alpha_{3t}FINV_{it} + u_{it}, \quad (1)$$

$$MVE_{it} = \alpha'_{0t} + \alpha'_{1t}BVE_{Bit} + \alpha'_{2t}FINV_{it} + u'_{it}, \quad (2)$$

where i and t denote firms and years; MVE is market value of common equity; BVE_B is book value of common equity before investment securities; $BINV$ is investment securities based on GAAP; $FINV$ is fair value of investment securities; and u and u' are disturbance terms.¹⁰ All variables are deflated by the number of common shares outstanding adjusted for stock splits and dividends to mitigate effects of heteroscedasticity. Incremental explanatory power of investment securities' fair values will be observed if the amount either (1) is a reliable measure of a value-relevant asset, or (2) reflects the explanatory power of correlated omitted variables.

A coefficient different from zero on $FINV$ in equation (1) indicates that fair values provide explanatory power incremental to historical costs. Because investment securities' fair values equal historical costs plus unrealized appreciation/depreciation ($DIFINV$), equation (1) is econometrically equivalent to

$$MVE_{it} = \alpha_{0t} + \alpha_{1t}BVE_{Bit} + \gamma_{2t}BINV_{it} + \alpha_{3t}DIFINV_{it} + u_{it} \text{ where } \gamma_{2t} = \alpha_{2t} + \alpha_{3t}.$$

⁷Other reasons include (1) investors using different asset and earnings information, and (2) potential differential impact of management's judgment in determining the amounts. Investigating these is beyond the scope of this study.

⁸Prior research provides little guidance on whether an asset and liability or earnings approach is preferred. Ohlson's (1989) valuation model linking earnings and net assets by assuming "clean surplus" is not used here because clean surplus is more restrictive than GAAP. Even viewing earnings as changes in assets, Landsman and Magliolo (1988) show that preference for a levels or changes specification is difficult to specify ex ante.

⁹Similar relations are estimated in, e.g., Landsman (1986), Harris and Ohlson (1987), Beaver et al. (1989), Barth (1991), and Barth et al. (1991).

¹⁰ BVE_B is adjusted for the tax effect of unrealized securities appreciation or depreciation ($FINV - BINV$). The findings are similar whether BVE_B or $FINV$ is so adjusted, or whether both $FINV$ and $BINV$ are calculated net of tax.

Thus, a coefficient different from zero on *FINV* in equation (1) also indicates that unrealized investment securities appreciation/depreciation provides explanatory power incremental to historical costs. Finding both α_{2t} and α_{3t} significantly different from zero suggests that separate disclosure of investment securities fair value components is warranted for investors in valuing banks' common equity (Jennings 1990). Differences in estimation error or value-relevance between the components are reasons for observing different coefficients.

A coefficient significantly different from zero on *FINV* in equation (2) indicates that investment securities fair values provide explanatory power incremental to book value of equity before investment securities. Because *FINV* and *BINV* are correlated, multicollinearity could result in estimates of α_{2t} and α_{3t} in equation (1) that are statistically indistinguishable from zero. Equation (2) permits assessing the explanatory power of *FINV* without such effects. In a simple setting, e.g., if the accounting variables equaled the amounts implicit in share prices and there were no omitted variables, the coefficients in equation (2) would equal one. Neither condition is likely to hold with actual accounting data, but the simple setting provides a benchmark for assessing the investment securities measure's characteristics.

Securities Gains and Losses

Analogously, fair value securities gains and losses are investigated by partitioning earnings into securities gains and losses and earnings before securities gains and losses. In a simple setting, e.g., perfect and complete markets, the coefficient on earnings before securities gains and losses would equal the reciprocal of the cost of capital (Miller and Modigliani 1966) and that on securities gains and losses would equal one because such gains and losses are transitory. The specification is similar to those in BBW and WL; the findings' robustness to alternative specifications is explored below.

The estimation equations are:

$$R_{it} = \beta_{0t} + \beta_{1t}\Delta E_{Bt} + \beta_{2t}RSGL_{it} + \beta_{3t}FSGL_{it} + u_{it} \quad (3)$$

$$R_{it} = \beta'_{0t} + \beta'_{1t}\Delta E_{Bt} + \beta'_{2t}FSGL_{it} + u'_{it} \quad (4)$$

where i and t denote firms and years; R is annual stock return; $\Delta E_B = E_{Bt} - E_{Bt-1}$ where E_B is earnings before securities gains and losses; $RSGL$ is securities gains and losses based on GAAP (i.e., realized); $FSGL$ is fair value securities gains and losses (i.e., realized plus unrealized); and u and u' are disturbance terms.

Equations (3) and (4) require specifying expected earnings and its components. A random walk expectations model for earnings before securities gains and losses is plausible given prior research and is consistent with BBW. As BBW and WL explain, an expectation of zero is more plausible for securities gains and losses. Descriptive statistics in table 1 support this assumption because the securities gains and losses variables' means are indistinguishable from zero. Because returns is the dependent variable, all other variables are deflated by beginning-of-year price (Christie 1987).

Analogously to equation (1) for investment securities, equation (3) permits assessing whether fair value securities gains and losses (or equivalently, unrealized securities gains and losses, because fair value gains and losses equal realized plus unrealized gains and losses) provide explanatory power in explaining bank share returns beyond earnings before securities gains and losses and realized gains and losses. Equation (4) permits determining whether fair value securities gains and losses, *FSGL*, have explanatory power incremental to earnings before

securities gains and losses. As with investment securities, statistical tests include whether the coefficients on *RSGL* and *FSGL* differ from zero, and, in equation (4), whether the coefficient on *FSGL* significantly differs from one. In addition to reasons offered for investment securities, β_2 could differ from β_3 because of differences among banks in tax status, and the effects of management selectively realizing securities gains and losses (e.g., income smoothing).

Viewing equations (3) and (4) as change specifications of equations (1) and (2), suggests that earnings rather than changes in earnings is the appropriate independent variable in equations (3) and (4). This view eliminates the need to specify expected earnings and its components. Thus, the following equations also are estimated:

$$R_{it} = \delta_{0t} + \delta_{1t}E_{B_{it}} + \delta_{2t}RSGL_{it} + \delta_{3t}FSGL_{it} + u_{it} \quad (5)$$

$$R_{it} = \delta'_{0t} + \delta'_{1t}E_{B_{it}} + \delta'_{2t}FSGL_{it} + u'_{it} \quad (6)$$

Relating Investment Securities Fair Values to Gains and Losses

Describing the relation between fair value investment securities and securities gains and losses illustrates the potential for them to have different valuation implications. Assume investment securities fair values (*FINV*) measure "true" values (*FINV*^{*}) with error: $FINV_t = FINV_t^* + e_t$. Then, fair value securities gains and losses, *FSGL*, equal $FSGL^* + (e_t - e_{t-1})$ ¹¹ where *FSGL*^{*} are "true" value securities gains and losses. Fair value investment securities are not merely the sum over time of securities gains and losses, which equal realized plus unrealized gains and losses ($FSGL_t = RSGL_t + URSGL_t$). Realized gains and losses reflect the proceeds from securities sold. Proceeds affect cash or receivables, but not investment securities. Similarly, investment securities purchases do not affect gains and losses, only cash or payables and investment securities. Thus, fair value investment securities stated in terms of gains and losses, are

$$\begin{aligned} FINV_t &= \sum_{j=1}^t (URSGL_j + \text{net purchases of investment securities at cost}_j) \\ &= \sum_{j=1}^t (URSGL_j^* + \text{net purchases of investment securities at cost}_j + (e_j - e_{j-1})) \end{aligned} \quad (7)$$

and $FSGL_t = URSGL_t^* + RSGL_t + (e_t - e_{t-1})$ where *URSGL*^{*} is true unrealized securities gains and losses. In equation (7), the sum over *j* of $(e_j - e_{j-1})$ reduces to $(e_t - e_0)$ and assuming e_0 equals zero because at acquisition the purchase price equals true value, it reduces further to e_t , as assumed above.

Thus, even if fair values are relevant to investors, differences in findings between investment securities and securities gains and losses could arise depending on the estimation error's, *e*, characteristics. For example, if investment securities fair value estimates are relatively reliable, *e*'s variance likely is small relative to *FINV*^{*}. But, if *e* is "white noise" or is not highly positively serially correlated, the variance of $(e_t - e_{t-1})$, which equals $2 \text{ var}(e) - 2 \text{ cov}(e_t, e_{t-1})$, could be large relative to *FSGL*^{*}; it could be twice the variance of *e*.¹²

¹¹ $FSGL_t = RSGL_t - \Delta FINV_t + \Delta FINV_t = RSGL_t - \Delta FINV_t + \Delta FINV_t^* + (e_t - e_{t-1}) = FSGL_t^* + (e_t - e_{t-1})$. This assumes realized securities gains and losses are error free. However, because any measurement error also is in historical costs, it does not affect the comparison of the two measures. BBW and WL offer reasons why market participants might view realized securities gains and losses as measured with error.

¹² Because the *e*'s are unobservable, one cannot estimate directly the variance of *e* or $(e_t - e_{t-1})$. However, *FSGL* should be serially uncorrelated if it accurately measures *FSGL*^{*} because fair value securities gains and losses should

This would occur if the fair value estimation process simply is noisy. If so, one could observe significant explanatory power for fair value investment securities, but not for fair value securities gains and losses. Alternatively, if e 's serial correlation is sufficiently positive to make the variance of $(e_t - e_{t-1})$ relatively small, one could find the opposite: fair value securities gains and losses could have significant power in explaining bank share prices, but fair value investment securities might not. Such serial correlation could arise from biased estimation techniques, or from management exercising discretion in estimating fair values. Managements' motives to bias the fair value estimates are unclear given that the fair value estimates only are disclosed, and do not affect directly reported income or net worth. The empirical findings reported below provide evidence on the estimation error's characteristics.

IV. Empirical Results

Data and Sample Firms

The sample comprises primarily U.S. banks whose financial statement data are on the 1990 Compustat Annual Bank Tape, the source of most data items. Investment securities fair value estimates ($FINV$) are obtained from annual reports. Fair value securities gains and losses ($FSGL$) equal the annual change in unrealized investment securities appreciation/depreciation plus realized gains and losses, net of a provision for income taxes:

$$FSGL = (1 - TR) * [(FINV_t - BINV_t) - (FINV_{t-1} - BINV_{t-1})] + RSGL.$$

TR is the year's statutory tax rate. Banks report realized gains and losses ($RSGL$) net of tax.

Table 1 presents descriptive statistics for the regression variables. Recall that BVE_B is book value of equity minus investment securities. Because investment securities is a large bank asset and banks are highly leveraged, BVE_B 's mean is negative. Any deferred taxes related to investment securities also contribute to the negative mean because they are part of BVE_B . On average, investment securities fair values are less than book value. Thus, if these estimates were used to recognize investment securities, the sample banks would report lower net worth than under GAAP.

Explanatory Power of Investment Securities Fair Value Estimates

Table 2 presents regression summary statistics from 20 annual cross-sectional estimations of equation (1), and two Z-statistics to test significance of the annual t-statistics: Z1 assumes they are independent, and Z2 corrects for cross-sectional and serial correlation.¹³ In almost all years the White (1980) test cannot reject the null of homoscedasticity and correct model

not depend on prior period information. Regression of $FSGL$ on lagged $FSGL$ (using fixed effects estimation with fixed firm effects) indicates a significant negative relation. Because the correlation between $FSGL_t$ and $FSGL_{t-1}$ equals zero, $Cov(FSGL_t, FSGL_{t-1})$ equals $Cov(e_t, e_{t-1})$ minus the variance of e . Thus, if e 's serial covariance is positive, which is likely if management uses discretion in estimating fair values, a negative relation between $FSGL_t$ and $FSGL_{t-1}$ is consistent with the assumptions above when e 's variance exceeds its serial covariance, which is plausible. It also is consistent with negative serial covariance of e , which is plausible if the errors are mean reverting. Differences in findings also could arise if the information content of net purchases of investment securities and realized securities gains and losses differ. However, no extant theory predicts such differences and so this explanation is not pursued here.

¹³ Z1 equals $1/\sqrt{N} \sum_{j=1}^N t_j / \sqrt{k_j / (k_j - 2)}$ where t_j is the t-statistic for year j , k_j is the degrees of freedom, and N is the number of years (Healy, et al. 1987). If the parameters are not independent, the Z-statistic likely is overstated. However, $Z2 = \bar{t} / (sdev(t) / \sqrt{(N-1)})$ corrects for the potential lack of independence.

specification.¹⁴ Table 2 also presents statistics from estimating a fixed effects model that permits pooling observations to increase power while mitigating cross-sectional and serial correlation that could bias reported test statistics. It assumes the regression residuals comprise year-specific, firm-specific, and random components. Analysis of residuals indicates that the approach is successful in mitigating both types of correlation. As expected, the coefficients on BVE_B are always significantly positive.

Table 1
Descriptive Statistics for Regression Variables: 1971-1990

	<i>Mean</i>	<i>Std dev of annual means</i>
Investment Securities Regressions:		
<i>MVE</i>	15.253	5.719
<i>BVE_B</i>	-29.000	7.285
<i>BINV</i>	45.188	10.969
<i>FINV</i>	44.191	11.476
Securities Gains and Losses Regressions:		
<i>R</i>	0.245	0.235
ΔE_B	0.011	0.013
E_B	0.152	0.048
<i>RSGL</i>	-0.001	0.005
<i>FSGL</i>	-0.005	0.077

Sample comprises banks with data included in the 1990 Compustat Bank Tape. Number of observations used in computing the mean is 99.5 and 86.8 for the investment securities and securities gains and losses regressions. Investment securities regression variables are deflated by number of shares, securities gains and losses regression variables are deflated by beginning-of-year price, and

- MVE* = market value of common equity,
- BVE_B* = book value of common equity before investment securities,
- BINV* = investment securities based on GAAP,
- FINV* = fair value estimate of investment securities,
- R* = annual stock return,
- ΔE_B = earnings before securities gains and losses,
- E_B = $E_{Bt} - E_{Bt-1}$,
- RSGL* = securities gains and losses based on GAAP (i.e., realized), and
- FSGL* = fair value securities gains and losses (i.e., realized plus unrealized).

¹⁴ Equations (1) and (2) estimated without deflation yield similar findings. As expected, in undeflated form the White (1980) test rejects homoscedasticity and corrects model specification in most years.

Table 2
Summary Statistics for Bank Investment Securities Regressions: 1971-1990
 $MVE_t = \alpha_{0t} + \alpha_{1t}BVE_{Bt} + \alpha_{2t}BINV_t + \alpha_{3t}FINV_t + u_t$

	α_{0t}	$(t\alpha_{0t})$	α_{1t}	$(t\alpha_{1t})$	α_{2t}	$(t\alpha_{2t})$	α_{3t}	$(t\alpha_{3t})$	adj R ²	nobs
Summary of twenty separate-year cross-sectional regressions:										
mean	1.94	1.76	0.79	11.54	-0.87	-1.76	1.70	3.83	.8237	99.5
std dev	3.19	3.49	0.27	3.47	1.04	1.77	1.01	1.69	.1271	29.5
Z1		7.81		50.75		-7.82		16.95		
Z2		2.20		14.50		-4.34		9.86		
# sign. ≠ 0		14		20		10		16		
Fixed effects										
estimation:	-	-	0.69	35.42	0.05	0.70	0.73	9.32	.8600	1990

MVE = market value of common equity,
 BVE_B = book value of common equity before investment securities,
 $BINV$ = investment securities based on GAAP,
 $FINV$ = fair value estimate of investment securities,
 u = disturbance term, and
 t = denotes year.

All variables are deflated by number of shares outstanding. Z1 and Z2 statistics test whether the time-series mean t-statistic equals zero. Z1 equals $1/\sqrt{N} \sum_{j=1}^N t_j / \sqrt{k_j/(k_j-2)}$ where t_j is the t-statistic for year j , k_j is the degrees of freedom for year j , and N is the number of years. Z2 equals $\bar{t} / (\text{stddev}(t) / \sqrt{N-1})$.

The table 2 findings indicate that fair value investment securities and unrealized investment securities appreciation/depreciation have explanatory power incremental to historical costs (and book value of equity before investment securities).¹⁵ The coefficient on *FINV*, α_3 , is significantly positive in 16 of the 20 years. Moreover, both Z-statistics and the fixed effects estimation reject, at very low significance levels, the null hypothesis that α_3 equals zero. In ten years investment securities book values (*BINV*) have explanatory power incremental to fair values ($\alpha_2 = 0$ is rejected). However, the fixed effects estimation indicates that overall *BINV* has no explanatory power incremental to *FINV*; $\alpha_2 = 0$ cannot be rejected ($t = 0.70$). Thus fair values have more explanatory power than historical costs (Biddle and Seow 1992). This finding also suggests that separately disclosing the two components is unwarranted. Estimation of equation (2) (unreported) confirms these findings. The coefficient on *FINV* is significantly positive (mean = 0.84, $Z1 = 78.46$, $Z2 = 11.97$), and the fixed effects adjusted R^2 is the same as in table 2.¹⁶

These findings indicate that banks' investment securities fair values are relevant and reliable to investors, and that bank share prices act as if the fair values have more information content than historical costs. In fact, the evidence suggests that historical costs provide no explanatory power incremental to fair values.

Explanatory Power of Fair Value Securities Gains and Losses

Table 3, panel A presents regression summary statistics for equation (3). Similar to the investment securities regressions, the White (1980) test cannot reject homoscedasticity and correct model specification in almost all years, and all coefficients on ΔE_b are significantly positive.¹⁷ The coefficient on realized gains and losses, β_2 , is significantly negative using fixed effects estimation, and when the annual t-statistics are tested using either $Z1$ or $Z2$. BBW also find a negative coefficient on realized securities gains and losses and interpret it as evidence of income smoothing. Whether tax factors explain β_2 's sign is explored below.

Table 3, panel A provides inconsistent evidence as to whether including fair value (or, equivalently, unrealized) gains and losses in the regression provides explanatory power incremental to realized gains and losses (and earnings before securities gains and losses). β_3 is insignificantly different from zero in the annual regressions, yet it is significantly positive using fixed effects estimation, suggesting the annual regressions lack power. Even if fair value securities gains and losses are relevant to investors, error in estimating them could make power an important research design issue. Thus, the table 3 findings are consistent with fair value securities gains and losses being relevant to investors, but measured with significantly large error which hinders researchers' ability to document it. Using similar research designs, other studies document a significant relation between earnings components and share prices (e.g., Barth et al. 1992), suggesting that fair value securities gains and losses are less relevant and

¹⁵ t-statistics should be viewed as descriptive statistics even though Hansen (1982) discusses weaker conditions than finite sample normality necessary for asymptotic normality of OLS regressions. For discussion purposes, t-statistics exceeding $|1.96|$ ($|1.64|$) for two- (one-) sided tests are considered to indicate significance.

¹⁶ However, in most years and in the fixed effects estimation, the coefficients differ significantly from the theoretical value of one. Given the measurement error inherent in accounting numbers, this is not surprising (Barth 1991). Whether the coefficients equal the theoretical value is not this study's primary focus. However, the coefficients are reasonable compared to the benchmark (e.g., fixed effects estimates of coefficients on book value of equity before investment securities and investment securities' fair values are 0.69 and 0.79).

¹⁷ As in prior research (e.g., BBW) observations with $\Delta E_b > |300\%|$ are eliminated.

Table 3
Summary Statistics for Banks Securities Gains and Losses Regressions, with Changes in Earnings and Earnings as an Explanatory Variable: 1972-1990

Panel A: $R_t = \beta_{0t} + \beta_{1t}\Delta E_{Bt} + \beta_{2t}RSGL_t + \beta_{3t}FSGL_t + u_t$

	β_{0t}	$(t\beta_{0t})$	β_{1t}	$(t\beta_{1t})$	β_{2t}	$(t\beta_{2t})$	β_{3t}	$(t\beta_{3t})$	adj R ²	nobs
Summary of nineteen separate-year cross-sectional regressions:										
mean	0.16	4.02	4.83	4.46	-1.16	-0.55	0.10	0.19	.2330	86.8
std dev	0.21	6.11	6.52	2.28	4.53	0.90	1.11	1.68	.1579	22.0
Z1		17.31		19.19		-2.36		0.80		
Z2		2.79		8.29		-2.57		0.47		
# sign. $\neq 0$		16		18		2		6		
Fixed effects estimation	—	—	2.73	17.29	-1.13	-2.51	0.18	1.98	.6549	1649

Panel B: $R_t = \delta_{0t} + \delta_{1t}E_{Bt} + \delta_{2t}RSGL_t + \delta_{3t}FSGL_t + u_t$

	δ_{0t}	$(t\delta_{0t})$	δ_{1t}	$(t\delta_{1t})$	δ_{2t}	$(t\delta_{2t})$	δ_{3t}	$(t\delta_{3t})$	adj R ²	nobs
Summary of nineteen separate-year cross-sectional regressions:										
mean	-0.22	-3.19	3.13	5.66	-0.63	-0.37	0.30	0.23	.2914	86.8
std dev	0.23	3.73	1.17	2.49	33.34	0.82	1.11	1.21	.1615	22.0
Z1		-13.75		24.40		-1.60		0.97		
Z2		-3.64		9.64		-1.94		0.80		
# sign. $\neq 0$		10		18		1		2		
Fixed effects estimation	—	—	3.32	27.26	-0.77	-1.92	0.11	1.39	.7236	1649

R = annual stock return,
 ΔE_B = $E_{Bt} - E_{Bt-1}$ where E_B is earnings before securities gains and losses,
 $RSGL$ = securities gains and losses based on GAAP (i.e., realized),
 $FSGL$ = fair value securities gains and losses (i.e., realized plus unrealized),
 u = disturbance term, and
 t = denotes year.

All variables are deflated by beginning-of-year price. Z1 and Z2 statistics test whether the time-series mean t-statistic equals zero. Z1 equals $1/\sqrt{N} \sum_{j=1}^N t_j / \sqrt{k_j/(k_j-2)}$ where t_j is the t-statistic for year j , k_j is the degrees of freedom for year j , and N is the number of years. Z2 equals $\bar{t}/(\text{stddev}(t)/\sqrt{(N-1)})$.

reliable than other earnings components. If unrealized securities gains and losses are included in earnings, the evidence suggests that separately disclosing them is appropriate.

Unreported findings from equation (4) are similar: the coefficients on *FSGL* differ insignificantly from zero in the annual regressions (mean = 0.15, $Z_1 = 0.68$, $Z_2 = 0.40$) but are significantly positive using fixed effects (coef. = 0.16, $t = 1.73$). Thus, the equation (3) findings do not appear attributable to multicollinearity. However, consistent with the presence of measurement error, *FSGL*'s coefficient differs significantly from the benchmark of one (fixed effects $t = 9.08$).

Table 3, panel B presents findings from estimating equation (5) which includes earnings rather than earnings changes as an explanatory variable. They are similar to those in panel A. The only notable difference is that the coefficient on fair value securities gains and losses, *FSGL*, no longer differs statistically from zero, even using fixed effects estimation.¹⁸ These findings reinforce the overall conclusion that documenting incremental explanatory power for fair value securities gains and losses is difficult, suggesting it has less relevance and reliability than other earnings components.

Specification Checks

Estimating alternative specifications indicates that the findings are robust. First, to investigate whether tax factors drive the table 3 findings, a version of equation (3) that follows WL (using fixed effects estimation) was estimated, permitting the coefficient on realized securities gains and losses to vary depending on whether a gain was in a year the bank had available net operating loss (NOL) or investment tax credit (ITC) carryforwards, a loss was in a year without such carryforwards, or otherwise. Consistent with WL predictions, the unreported findings indicate that the negative coefficient on realized gains and losses in table 3 is attributable to losses in years banks had available neither NOL nor ITC carryforwards. However, the fair value securities gains and losses' coefficient was smaller than in table 3, and no longer significant ($\hat{\beta}_3 = 0.10$, $t = 0.93$ and $\hat{\beta}_3 = 0.07$, $t = 0.76$ in the changes in earnings and earnings specifications).¹⁹ This supports the interpretation of table 3 that fair value and unrealized securities gains and losses at best provide marginal incremental explanatory power. Moreover, it indicates that realized securities gains and losses have more explanatory power than fair value (or unrealized) securities gains and losses, because β_2 differs significantly from zero while β_3 does not.

Second, following Scholes et al. (1990) the securities gains and losses regressions were estimated after including as explanatory variables the bank's estimated primary capital ratio and its square. The equations also were estimated permitting different coefficients on earnings before securities gains and losses and realized securities gains and losses for three groups of banks, depending on the primary capital ratio. Without the WL differential coefficients on

¹⁸Unreported findings from equation (6) are similar: *FSGL*'s coefficient differs insignificantly from zero (mean coef. = 0.27, $Z_1 = 0.73$, $Z_2 = 0.61$, fixed effects coef. = 0.10, $t = 1.21$). One explanation for this finding is that when earnings is an explanatory variable, the relation between *FSGL* and bank shares returns is captured by interest income, a component of E_p . This does not affect equations (3) and (4) because relatively stable interest income effectively is eliminated when earnings are first-differenced. Also, the White (1980) test rejects homoscedasticity and correct model specification in most years. When rejected, White (1980) standard errors are used to calculate statistical significance. Barth and Kallapur (1993) provide evidence that in similar samples White standard errors closely approximate true standard errors.

¹⁹Available NOL and ITC data in bank annual reports resulted in only 1129 observations from 1980 to 1990. The insignificance for fair value securities gains and losses could be attributable to, at least in part, the smaller sample size. Estimating equations (3) and (5) on the sample for which NOL and ITC data are available also results in fair value securities gains and losses coefficients that are statistically indistinguishable from zero.

realized securities gains and losses, the unrealized gains and losses coefficients differed significantly from zero. However, after incorporating the WL specification, they did not.

Third, because bank managers can selectively realize securities gains and losses, gains and losses might be valued differently, particularly for strong versus weak banks. Thus, equation (3) was estimated using fixed effects permitting four different coefficients on realized gains and losses for gains versus losses and strong versus weak banks. Banks were considered strong in a given year if their market-to-book ratio exceeded the median market-to-book ratio of all sample bank year observations. Although the realized securities gains and losses coefficients differed from each other (the strong/gain coefficient was significantly positive, the strong/loss and weak/loss coefficients were significantly negative, and the weak/gain coefficient differed insignificantly from zero), the coefficient on fair value gains and losses were insignificantly different from zero.²⁰

Other specification checks also yielded similar findings. (1) As in BBW, market-to-book ratios were regressed on earnings components deflated by book value of equity, and annual percentage changes in price were regressed on percentage changes in earnings. The market-to-book regressions also were estimated deflating by the number of shares. (2) The tax provision rate (TR) was set equal to the rate implicit in the disclosed tax effect of realized securities gains and losses, and to zero. (3) Market value of equity three months after fiscal year end was used to ensure financial statement disclosures are in the public domain. (4) The regressions were estimated in time series for each bank with at least ten yearly observations. (5) Earnings before securities gains and losses (E_b) was included as an explanatory variable in equations (3) and (4). (6) There are no large outliers as defined by the Belsley et al. (1980) DFFITS statistic.²¹

V. Interpretations of the Findings

The findings indicate that fair value securities gains and losses' combined relevance and reliability to investors is marginal, but whether the problem is relevance or reliability is not determinable from the reported results. However, investment securities' fair value estimates are sufficiently relevant and reliable to be reflected in share prices. All else equal, if investment securities fair values are relevant to investors, one would expect the same for fair value securities gains and losses. Together, the securities gains and losses and investment securities findings are consistent with two principal interpretations. (1) As explained in section III, under certain conditions measurement error effects can be more pronounced for securities gains and losses than for investment securities. (2) Securities gains and losses could be offset by correlated unrecognized gains and losses on other assets and liabilities (correlated omitted variables). Because the findings cannot be attributed unambiguously to either interpretation, this section describes analyses that explore which interpretation is more plausible.

Estimation Error

The estimation error interpretation is especially important to the fair value accounting debate because critics of the method cite the questionable reliability of fair value estimates as a major reason against using fair value accounting. As previously noted, investment securities' fair values are among the most reliably estimable of bank assets and liabilities. Estimation error detracting from value-relevance here raises the question of whether noisier measures can add

²⁰Equation (3) also was estimated on the four subsamples, effectively permitting all coefficients to differ across the bank/gain types, with similar findings. The coefficient on fair value gains and losses never differed significantly from zero.

²¹Two firms with large statistics were eliminated with virtually no effect on the findings.

explanatory power. Three analyses explore this interpretation's plausibility: (1) partitioning the sample based on characteristics related to differential estimation error, (2) investigating the effects of aggregation, and (3) using simulation. The findings are presented in table 4, panels A-C.

Composition of the Investment Securities Portfolio

Fair value estimation error is expected to be smaller for U.S. Treasury securities than for municipal bonds. Also, larger banks are expected to have available more precise estimates of fair value than smaller banks reflecting their market power (e.g., more precise quotes are obtainable for larger rather than smaller blocks of securities) and the relative sophistication of their investment departments. Thus, equations (1)-(4) were estimated on four subsamples, partitioned in each year on market value of equity and the proportion of the investment securities portfolio comprised of U.S. Treasury securities. The annual upper and lower quartiles of each variable were used to identify the subsamples.

Fixed effects estimation findings for equations (1) and (3) presented in table 4, panels A1 and A2, generally are consistent with estimation error. Panel A1 reveals that for large banks with a high proportion of U.S. Treasury securities, fair value securities gains and losses provide significant incremental explanatory power ($t = 2.57$). However, for large banks with a low proportion (i.e., high proportion of state, municipal, and other bonds) the coefficient is negative and insignificantly different from zero ($t = -0.85$). For small banks, the coefficient differs insignificantly from zero regardless of the proportion of U.S. Treasury securities ($t = 0.67$ and $t = -0.20$). The coefficients on realized securities gains and losses all differ insignificantly from zero. Unreported findings from estimating equation (4) are similar: only for large banks with a high proportion of U.S. Treasury securities do fair value securities gains and losses provide incremental explanatory power ($t = 2.62$ and $t = -1.13, 0.70$, and -0.50 for the other three subsamples).

The investment securities findings in panel A2 indicate that the significance of investment securities fair value estimates for banks with a high proportion of U.S. Treasury securities is larger than for those with a low proportion, especially large banks. However, the significance levels exceed five percent. Unreported findings from estimating equation (2) suggest multicollinearity could be driving the panel A2 findings. When fair value investment securities does not compete with historical costs, its incremental explanatory power is highly statistically significant for banks with a high proportion of U.S. Treasury securities ($t = 4.95$ and 4.52 for large and small banks), unlike banks with a low proportion ($t = 1.44$ and 1.80 for large and small banks).

Aggregation over Longer Time Periods

Prior research (e.g., Easton et al. 1992; Kothari and Sloan 1992) finds that extending the returns cumulation period improves the explanatory power of accounting variables. Moreover, aggregation can mitigate the effects of estimation error in fair value securities gains and losses. Thus, using fixed effects estimation, equations (3) and (4) were estimated with returns calculated over periods of two to five years. Securities gains and losses for each period were the sum of the annual amounts. Change in earnings, ΔE_B , was permitted to have different coefficients each year.

Table 4, panel B presents findings from estimating equation (3) which are consistent with fair value securities gains and losses being relevant to investors but estimated with error. The coefficient on fair value securities gains and losses, and its t-statistic, increase with aggregation; however, using periods of more than four years does not enhance significance. The coefficients

Table 4
Summary Statistics for Banks Securities Gains and Losses and Investment
Securities Regressions: 1971-1990. Analyses to Explore Estimation
Error Interpretation of Tables 2 and 3 Findings

Panel A: Sample partitioned by size of bank and proportion of investment securities portfolio held in U.S. Treasury securities

$$A1: R_t = \beta_{0t} + \beta_{1t}\Delta E_{Bt} + \beta_{2t}RSGL_t + \beta_{3t}FSGL_t + u_t$$

	β_1	$(t\beta_1)$	β_2	$(t\beta_2)$	β_3	$(t\beta_3)$	adj R ²	nobs
BIG_LO	2.44	3.13	-2.37	-0.90	-0.75	-0.85	.7467	117
BIG_HI	2.64	1.25	0.49	0.12	1.29	2.57	.8626	74
SML_LO	4.76	7.35	-0.53	-0.18	-0.20	-0.20	.9050	76
SML_HI	1.40	1.55	0.14	0.05	0.30	0.67	.7377	106

$$A2: MVE_t = \alpha_{0t} + \alpha_{1t}BVE_{Bt} + \alpha_{2t}BINV_t + \alpha_{3t}FINV_t + u_t$$

	α_1	$(t\alpha_1)$	α_2	$(t\alpha_2)$	α_3	$(t\alpha_3)$	adj R ²	nobs
BIG_LO	0.37	1.85	0.01	0.03	0.40	0.93	.9610	117
BIG_HI	0.73	4.06	0.34	0.91	0.36	1.36	.9798	74
SML_LO	0.86	1.75	0.59	1.13	0.25	0.53	.9633	76
SML_HI	0.63	3.98	0.30	0.82	0.35	1.02	.9505	106

Panel B: Return windows ranging from one to five years

$$\sum_{t=1}^{Years} R_t = \beta_{0t} + \sum_{t=1}^{Years} \beta_{1t}\Delta E_{Bt} + \beta_2 \sum_{t=1}^{Years} RSGL_t + \beta_3 \sum_{t=1}^{Years} FSGL_t + u$$

Years	Mean β_1	Mean $(t\beta_1)$	β_2	$(t\beta_2)$	β_3	$(t\beta_3)$	adj R ²	nobs
1	2.73	17.29	-1.13	-2.51	0.18	1.98	.6549	1649
2	4.29	16.11	-1.73	-2.91	0.38	3.43	.7351	1458
3	5.77	15.88	-2.14	-3.09	0.46	3.37	.7954	1290
4	6.96	14.96	-2.20	-2.71	0.47	2.68	.8325	1143
5	8.00	14.40	-2.32	-2.39	0.45	2.04	.8577	1015

Panel C: Simulating measurement error in investment securities fair value estimates

C1: Zero measurement error in BVE_B and $FINV$ (used to calculate $FSGL$). No measurement error added to E_B .

$$R_t = \beta_{0t} + \beta_{1t}\Delta E_{Bt} + \beta_{2t}RSGL_t + \beta_{3t}FSGL_t + u_t$$

	β_{0t}	$(t\beta_{0t})$	β_{1t}	$(t\beta_{1t})$	β_{2t}	$(t\beta_{2t})$	β_{3t}	$(t\beta_{3t})$	adj R ²	nobs
Summary of nineteen separate-year cross-sectional regressions:										
mean	0.19	9.67	1.63	3.39	-0.31	-0.21	0.94	3.44	.2731	86.8
std dev	0.05	4.03	1.25	2.99	3.60	1.58	0.78	2.94	.2177	22.0
Z1		41.64		16.93		-0.89		14.85		
Z2		10.17		5.56		-0.55		4.97		
# sign. $\neq 0$		19		16		3		15		
Fixed effects estimation:	—	—	1.03	14.17	-0.63	-3.65	1.26	31.93	.7902	1648

(Continued)

Table 4 (Continued)

C2: 0-10% measurement error in $FINV$ (used to calculate $FSGL$). Zero measurement error in BVE_B . No measurement error added to E_B .

$$R_t = \beta_{0t} + \beta_{1t}\Delta E_{Bt} + \beta_{2t}RSGL_t + \beta_{3t}FSGL_t + u_t$$

	β_{0t}	$(t\beta_{0t})$	β_{1t}	$(t\beta_{1t})$	β_{2t}	$(t\beta_{2t})$	β_{3t}	$(t\beta_{3t})$	adj R^2	nobs
Summary of nineteen separate-year cross-sectional regressions:										
mean	0.20	12.41	1.74	3.99	0.50	0.34	0.10	1.18	.2124	86.8
std dev	0.07	6.11	1.12	2.84	3.85	1.83	0.23	2.43	.1900	22.0
Z1		53.47		17.19		1.44		5.09		
Z2		8.61		5.97		0.78		2.06		
# sign. $\neq 0$		19		15		4		6		
Fixed effects estimation:										
	—	—	1.36	15.43	-0.29	-1.38	0.24	13.00	.6824	1648

$$MVE_t = \alpha_{0t} + \alpha_{1t}BVE_{Bt} + \alpha_{2t}BINV_t + \alpha_{3t}FINV_t + u_t$$

	α_{0t}	$(t\alpha_{0t})$	α_{1t}	$(t\alpha_{1t})$	α_{2t}	$(t\alpha_{2t})$	α_{3t}	$(t\alpha_{3t})$	adj R^2	nobs
Summary of twenty separate-year cross-sectional regressions:										
mean	0.00	-0.19	1.01	141.92	0.39	18.55	0.61	27.53	.9984	99.5
std dev	0.12	1.35	0.02	42.89	0.14	9.94	0.14	6.89	.0009	29.5
Z1		-0.82		624.77		82.05		121.77		
Z2		-0.61		14.42		8.13		17.42		
# sign. $\neq 0$		2		20		20		20		
Fixed effects estimation:										
	—	—	0.98	354.66	0.36	56.97	0.61	92.33	.9973	1990

MVE	=	market value of common equity,
BVE_B	=	book value of common equity before investment securities,
$BINV$	=	investment securities based on GAAP,
$FINV$	=	fair value estimate of investment securities,
R	=	annual stock return,
ΔE_B	=	$E_{Bt} - E_{Bt-1}$ where E_B is earnings before securities gains and losses,
$RSGL$	=	securities gains and losses based on GAAP (i.e., realized),
$FSGL$	=	fair value securities gains and losses (i.e., realized plus unrealized),
u	=	disturbance term,
t	=	denotes year,
BIG(SML)	=	banks with market value of equity in upper (lower) quartile of total sample, and
HI(LO)	=	banks with proportion of U.S. Treasury securities in investment securities portfolio in upper (lower) quartile of total sample.

Investments securities regression variables are deflated by number of shares, securities gains and losses regression variables are deflated by beginning-of-year price.

for fair value securities gains and losses for the two- to five-year aggregation periods are 0.38, 0.46, 0.47, and 0.45 ($t = 3.43, 3.37, 2.68$, and 2.04) as compared with a coefficient of 0.18 ($t = 1.98$) reported in table 3. Unreported findings from estimating equation (4) are similar.

Simulation

Estimation error in the fair value estimates was simulated to determine “how much” error is consistent with the reported findings. First, MVE was set equal to book value of equity before investment securities, BVE_B , plus fair value investment securities, $FINV$. Then random error was added to $FINV$, $FSGL$ was calculated, and equations (1) and (3) were estimated using the simulated variables. Error was added only to the non-U.S. Treasury proportion of the investment securities portfolio because these securities are those most likely to be estimated with error. The error is distributed uniformly with mean zero and limits of varying percents ($[a,b]$, e.g., $[-0.1, 0.1]$ for ten percent), and variance equal to $(a-b)/12$ (0.33 percent for errors from $[-0.1, 0.1]$).²² Fair value estimates for U.S. Treasury securities were assumed to be error free.

Table 4, panel C1 indicates that with no estimation error in investment securities fair values, the coefficients on fair value securities gains and losses, $FSGL$, are significantly positive in 15 of the 19 years and overall ($Z1 = 14.85, Z2 = 4.97$), and using fixed effects estimation ($t = 31.93$). This suggests that the separate-year research design is sufficiently powerful to detect a relation between fair value securities gains and losses and share returns. Similar to table 3, the realized securities gains and losses coefficient only differs significantly from zero in three years, and $Z1$ ($= -0.89$) and $Z2$ ($= -0.55$) indicate overall insignificance. It is significantly negative using fixed effects estimation ($t = -3.65$). As expected, the coefficients on earnings before securities gains and losses are significantly positive in almost all years, and in the fixed effects estimation. By construction, unreported coefficients and R^2 from the related investment securities regressions equal one.

Table 4, panel C2 indicates that estimation error of zero to ten percent (the mean error across banks equals zero) in non-U.S. Treasury investment securities results in statistically positive coefficients on $FSGL$ in equation (3) in six years, the same number of years as in table 3, although $Z1$ ($= 5.09$) and $Z2$ ($= 2.06$) indicate overall significance. The coefficients on fair value investment securities, $FINV$, remain significantly positive in all years. Using fixed effects estimation, $FSGL$'s coefficient dropped from 1.26 to 0.24 (compared with 0.18 in table 3) when the simulated error increased from zero (panel C1) to ranging from zero to ten percent (panel C2). However, the t -statistic only dropped from 31.93 to 13.00. To achieve a t -statistic as low as in table 3 for the fixed effects estimation, error of up to 25 percent in non-U.S. Treasury investment securities and up to 20 percent in earnings before securities gains and losses, E_B , was necessary (untabulated $t = 1.47$ for $FSGL$'s coefficient). E_B likely has error because accounting earnings do not measure perfectly economic earnings. Unreported findings also indicate that even when an analogous 20 percent error is introduced into book value before investment securities, the fair value investment securities coefficient remains significantly positive (fixed effects $t = 46.13$). Thus, although it appears that estimation error plausibly can largely account for the tables 2 and 3 findings, estimation error only in investment securities fair values does not account for them entirely.

²² The simulated errors are independent, which unlikely reflects reality. However, this analysis is intended to illustrate the potential for estimation error to explain the reported findings. If the true errors are correlated, the percent of error introduced should not be taken literally.

Correlated Omitted Variables

The findings for securities gains and losses also could be attributable to their being offset by other correlated, unrecognized gains and losses, although why we observe these offsetting effects for securities gains and losses, but not for investment securities is unclear. Securities gains and losses likely are offset by gains and losses on liabilities and magnified by those on loan assets, to the extent they have fixed rates. Off-balance sheet items can have either offsetting or magnifying effects, although if banks manage interest-rate exposure, e.g., through off-balance sheet hedges, the effects should be offsetting. If banks hedge *all* market risks, a zero coefficient on securities gains and losses would be expected. With incomplete hedging this would not hold.

From an econometric perspective, hedges are correlated omitted variables to the extent they are unrecognized, and thus omitted from the regression equation. There likely are other correlated omitted variables given the historical cost accounting model. Thus, two approaches explore the plausibility of the correlated omitted variables interpretation: (1) considering hedging effects, and (2) considering all types of correlated omitted variables. The findings are presented in table 5, panels A and B.

Effect of Hedging Activities

To explore whether banks' interest-rate risk hedging activities plausibly explain the overall weak findings for fair value securities gains and losses, banks were classified as hedgers or non-hedgers, and equations (1)–(4) were estimated using fixed effects for the two groups. Following Flannery and James (1984) and Beaver et al. (1985), a bank was classified as a non-hedger if its stock return varied significantly with the long-term government bond return (t-statistic greater than |1.96|), otherwise it was classified as a hedger. The government bond return was used because it represents essentially only interest rate risk.

Table 5, panels A1 and A2 present findings from estimating equations (1) and (3) for the two bank groups. Contrary to expectations, panel A1 reveals that fair value securities gains and losses only provide significant incremental explanatory power for *hedgers*. Unreported findings from estimating equation (4), where fair value securities gains and losses do not compete with historical costs, are similar. Thus, hedging activities do not appear to explain plausibly the reported findings.²³ The findings for investment securities in panel A2 differ in that the incremental explanatory power of investment securities is more significant for the non-hedger subsample ($t = 5.88$ versus 1.96). However, unreported findings indicate that the relation between hedge classification and explanatory power does not hold for equation (2).

Measurement Error Model Approach

Thus far the explanatory power of fair value investment securities and related gains and losses has been compared with historical costs. By assuming a structure for the measurement error likely present in each, the two methods can be compared from a measurement error perspective. The approach views accounting measures as variables measured with error and the amounts implicit in share prices as “true” variables. Because the approach is comparative, the effects of correlated omitted variables can be isolated. Thus it can help distinguish between the

²³ Monthly returns for four five-year periods were used to classify the banks. Bank stock and market returns were obtained from CRSP, and long-term government bond returns were obtained from Ibbotson and Sinquefeld (1991). The percentage of banks identified as non-hedgers varied over the estimation periods: 8 (1971–1975), 36 (1976–1980), 15 (1981–1985), and 16 (1986–1990). The small sample size also likely contributes to the insignificance of fair value securities gains and losses for non-hedgers.

Table 5
Summary Statistics for Banks Securities Gains and Losses and Investment Securities
Regressions: 1971-1990. Analyses to Explore Correlated Omitted Variables
Interpretation of Tables 2 and 3 Findings

Panel A: Banks partitioned into hedgers and non-hedgers based on significance of relation between their share returns and long-term U.S. government bond returns

A1: $R_t = \beta_{0t} + \beta_{1t}\Delta E_{Bt} + \beta_{2t}RSGL_t + \beta_{3t}FSGL_t + u_t$								
	β_1	$(t\beta_1)$	β_2	$(t\beta_2)$	β_3	$(t\beta_3)$	adj R^2	nobs
Hedgers	2.55	13.87	-2.22	-3.21	0.25	2.25	.6673	1290
Non-Hedgers	3.26	8.12	-0.44	-0.79	0.24	1.34	.6957	359

A2: $MVE_t = \alpha_{0t} + \alpha_{1t}BVE_{Bt} + \alpha_{2t}BINV_t + \alpha_{3t}FINV_t + u_t$								
	α_1	$(t\alpha_1)$	α_2	$(t\alpha_2)$	α_3	$(t\alpha_3)$	adj R^2	nobs
Hedgers	0.62	30.54	0.24	2.86	0.45	1.96	.8528	1577
Non-Hedgers	0.75	14.95	-0.07	-0.52	0.87	5.88	.9442	413

Panel B: Measurement error model approach

B1: $R = \beta'_0 + [\beta'_1 - (aY1 - bY2)] * \Delta E_B + [\beta'_2 - (cY2 - dY1)] * XSGL + u'$, XSGL is FSGL or RSGL

	<i>FSGL</i>		<i>RSGL</i>		χ^2	nobs		
	Y_{2F}	$t(Y_{2F})$	Y_{2R}	$t(Y_{2R})$			$Y_{2F} < Y_{2R}$	$Y_{2R} < Y_{2F}$
Summary of nineteen separate-year cross-sectional regressions:								
Mean	0.0028	8.61	0.0003	3.48	72.86	86.8	1	18
Std dev	0.0031	5.23	0.0004	2.10	85.52	22.0	0	16
Fixed effects estimation:	0.0094	210.11	0.0004	158,442	58,442	1649		

B2: $MVE = \alpha'_0 + [\alpha'_1 - (eY1 - fY2)] * BVE_B + [\alpha'_2 - (gY1 - hY2)] * XINV + u'$, XINV is FINV or BINV

	<i>FINV</i>		<i>BINV</i>		χ^2	nobs		$Y_{2F} < Y_{2B}$	$Y_{2B} < Y_{2F}$
	Y_{2F}	$t(Y_{2F})$	Y_{2B}	$t(Y_{2B})$					
Summary of twenty separate-year cross-sectional regressions:									
Mean	45.72	3.99	67.43	5.45	146.49	99.5	#	13	7
Std dev	58.10	4.78	77.19	6.16	160.84	30.3	# $\chi^2 > 3.84$	11	6
Fixed effects									
estimation:	114.21	15.89	131.22	18.17	354.08	1990			

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(Continued)

Table 5 (Continued)

MVE	= market value of common equity,
BVE_B	= book value of common equity before investment securities,
$BINV$	= investment securities based on GAAP,
$FINV$	= fair value estimate of investment securities,
R	= annual stock return,
ΔE_B	= $E_{Bt} - E_{Bt-1}$ where E_B is earnings before securities gains and losses,
$RSGL$	= securities gains and losses based on GAAP (i.e., realized),
$FSGL$	= fair value securities gains and losses (i.e., realized plus unrealized),
u'	= disturbance terms,
$Y2$	= measurement error term for investment securities or securities gains and losses, and
Hedgers (Non-Hedgers)	= banks with share returns varying insignificantly (significantly) with long-term U.S. government bond returns.

Lower $Y2$ implies smaller measurement error in investment securities or securities gains and losses. χ^2 statistic tests $Y_{2F} - Y_{2R}$ or $Y_{2F} - Y_{2B} = 0$, $\chi^2_{.95}(1) = 3.84$. $Y1$ estimates are untabulated and relate to ΔE_B or BVE_B 's measurement error. $a-h$ relate to the covariance matrix of certain variables estimated in a first-stage regression (unreported). See Barth (1991) for details.

estimation error and correlated omitted variables interpretations for the securities gains and losses findings.

The approach is from Barth (1991), modified to reflect investment securities (and earnings) variables' characteristics. In particular, here it is assumed that, in addition to long-term assets and liabilities (and hence BVE_B), earnings before securities gains and losses, E_B , book value of investment securities, $BINV$, and realized securities gains and losses, $RSGL$, have measurement error largely induced by historical cost accounting. These errors are assumed to have nonzero means and to be correlated with other measurement errors related to historical cost accounting, the accounting measures, and investors' implicit assessments. Estimation error in fair value securities gains and losses, $FSGL$, and investment securities, $FINV$, are assumed to be "white noise."²⁴

Table 5, panel B presents the findings, which are consistent with the incremental explanatory power findings. Because a lower $Y2$ indicates less measurement error, panel B1 reveals that realized securities gains and losses evidence less measurement error than fair value securities gains and losses vis-à-vis the amount implicit in share prices. This relation holds in 18 of the 19 years (significant in 16), and in the one exception year the difference is statistically insignificant. The findings from using fixed effects estimation are similar: Y_{2R} is less than Y_{2F} (0.0004 versus 0.0094) and $\chi^2 = 58,442$ indicates the difference is significant. Also consistent with the incremental explanatory power findings, panel B2 reveals that fair value investment securities, $FINV$, evidences less measurement error than historical costs, $BINV$. This relation holds in 13 of the 20 years (significant in 11), and in only six years is $BINV$'s measurement error significantly less than $FINV$'s. Findings from fixed effects estimation are similar: Y_{2F} is less than Y_{2B} (114.21 versus 131.22) and $\chi^2 = 354.08$ indicates the difference is significant.

The measurement error model approach findings indicate that the weak incremental explanatory power of fair value securities gains and losses in table 3 is not principally attributable to correlated omitted variables. Based on the model, if the correlation between any net omitted variable and measurement error in the historical cost amounts is negative, then the

²⁴ Assuming additional non-white noise error terms compared with Barth (1991) alters the components of the terms that reflect the measurement errors' covariance structure ($Y1$ and $Y2$), thus affecting interpretation of the findings. The interpretation depends on the sign of the correlation between the measurement errors and any omitted variables because the measurement errors in $RSGL$ and $BINV$ are assumed correlated with investors' implicit assessments (and, thus with omitted variables, if any) while $FSGL$ and $FINV$'s measurement errors are assumed to be white noise, and the analysis is comparative.

findings in table 3 for fair value securities gains and losses can be attributed solely to measurement error, and not to correlated omitted variables. Bankers' expressed concerns over using fair value measures only for investment securities suggest a negative correlation is likely. They assert that failure to recognize unrealized gains and losses on liabilities used to finance investment securities misstates earnings.²⁵

VI. Summary and Concluding Remarks

This study investigated how disclosed fair values of banks' investment securities and fair value securities gains and losses are reflected in share prices compared with historical costs, to determine which is more relevant and reliable to investors for valuing banks' equity. Previous research does not provide strong evidence that fair values are more relevant and reliable to investors than historical costs. Errors in fair value estimates is a primary explanation offered by these studies for these unexpected findings. Another explanation relates to cross-sectional differences in sample firms, e.g., industry membership. This study examined disclosed investment securities fair values which are considered more reliable than previously-studied fair value disclosures. Moreover, the sample firms here belong to one industry, banking. Thus, failure to establish value-relevance for fair values in this setting calls into question the ability to establish it in other settings.

The findings indicate that investment securities' fair values have explanatory power beyond historical costs. Strikingly, historical costs have *no* explanatory power incremental to fair values. These findings are robust to using several alternative specifications. The securities gains and losses findings differ in that whether fair values provide explanatory power incremental to historical costs depends on the estimation equation. Significant incremental explanatory power was found only in more powerful specifications, suggesting that fair value securities gains and losses are relevant to investors in valuing bank equity but, as with SFAS 33 and SFAS 19 disclosures, annual fair value gains or losses are estimated with sufficient error to make value-relevance difficult to establish.

Two principal interpretations for the findings were explored. (1) Error in estimating fair values is too large for fair value securities gains and losses to be value-relevant. It was shown that the weak fair value securities gains and losses findings can be reconciled with the strong fair value investment securities findings under this interpretation. (2) Securities gains and losses are being offset by unrecognized gains and losses on other assets and liabilities (correlated omitted variables). Neither interpretation is verifiable directly. However, evidence from supplemental analyses indicated that estimation error is the more plausible of the two. Moreover, the findings based on a measurement error model indicate that fair value securities gains and losses have more measurement error than realized gains and losses vis-à-vis the amount implicit in share prices, whereas fair value investment securities have less measurement error than historical costs.

The estimation error interpretation is particularly important to the fair value accounting debate because critics cite the questionable reliability of fair value estimates as a major reason against using fair value accounting. Fair values of investment securities are among the most reliably estimable of all bank asset and liability fair values. Even so, reliability of the securities

²⁵ With negative correlation the investment securities findings in table 2 cannot be attributed unambiguously to one or the other explanation. The correlation's true sign is unobservable. However, if it is positive the investment securities findings can be attributed solely to measurement error, but the securities gains and losses findings cannot unambiguously be attributed to either explanation. Note that neither sign eliminates measurement error as an explanation; only the correlated omitted variables explanation is eliminated.

gains and losses amount appears to be an issue. This raises the question of whether less reliable fair value estimates are appropriate to include in earnings.

References

- American Institute of Certified Public Accountants (AICPA). 1990. *Reporting by Financial Institutions of Debt Securities Held as Assets*. Proposed Statement of Position. New York, NY: AICPA.
- Barth, M. E. 1991. Relative measurement errors among alternative pension asset and liability measures. *The Accounting Review* 66 (July): 433-63.
- _____, W. H. Beaver, and W. R. Landsman. 1992. The market valuation implications of net periodic pension cost. *Journal of Accounting and Economics* 15 (March): 27-62.
- _____, _____, and C. H. Stinson. 1991. Supplemental data and the structure of thrift share prices. *The Accounting Review* 66 (January): 56-66.
- _____, _____, and M. A. Wolfson. 1990. Components of bank earnings and the structure of bank share prices. *Financial Analysts Journal* 46 (May/June): 53-60.
- _____, W. R. Landsman, and J. M. Wahlen. 1993. Fair value accounting: Effects on banks' earnings volatility, regulatory capital, and value of contractual cash flows. Working paper, Harvard Business School, Boston, MA.
- _____, and S. Kallapur. 1993. The effects of cross-sectional scale differences on regression results in empirical accounting research. Working paper, Harvard Business School, Boston, MA.
- Beaver, W. H., S. Datar, and M. A. Wolfson. 1992. The role of market value accounting in the regulation of insured depository institutions, in *The Reform of Deposit Insurance: Disciplining the Government and Protecting Taxpayers*, chapter 9 (Harper & Row: New York), 259-76.
- _____, C. Eger, S. Ryan, and M. A. Wolfson. 1989. Financial reporting, supplemental disclosures, and bank share prices. *Journal of Accounting Research* 27 (Autumn): 157-78.
- _____, _____, _____, and _____. 1985. Financial reporting, supplemental disclosures, and bank share prices. Working paper. Stanford University Graduate School of Business, Stanford, CA.
- _____, and W. R. Landsman. 1983. *Incremental Information Content of Statement 33 Disclosures*. FASB: Stamford, CT.
- _____, P. A. Griffin, and W. R. Landsman. 1982. The incremental information content of replacement cost earnings. *Journal of Accounting and Economics* (July): 15-39.
- _____, and S. G. Ryan. 1985. How well do Statement No. 33 earnings explain stock returns? *Financial Analysts Journal* (September/October): 66-71.
- Bell, T.B. 1983. Market reaction to reserve recognition accounting. *Journal of Accounting Research* (Spring): 1-17.
- Belsley, D. A., E. Kuh, and R. E. Welsch. 1980. *Regression Diagnostics*. New York: John Wiley and Sons.
- Bernard, V. and R. Ruland. 1987. The incremental information content of historical cost and current cost numbers: Time series analysis. *The Accounting Review* 62 (October): 701-22.
- _____, R. C. Merton, and K. G. Palepu. 1992. Mark-to-market accounting for U.S. banks and thrifts: Lessons from the Danish experience. Working paper. Harvard Business School. Boston, MA.
- Biddle, G. C. and G. S. Seow. 1992. Relative versus incremental information content: Cross-industry evidence for net income, cash flows, and sales. Working paper. University of Washington Graduate School of Business Administration. Seattle, WA.
- Bublitz, B., T. J. Frecka, and J. C. McKeown. 1985. Market association tests and FASB Statement No. 33 disclosures: A reexamination. *Journal of Accounting Research* (Supplement): 1-23.
- Christie, A. 1987. On cross-sectional analysis in accounting research. *Journal of Accounting and Economics* (December): 231-58.
- Easton, P. D., T. S. Harris, and J. A. Ohlson. 1992. Aggregate accounting earnings can explain most of security returns: The case of long return intervals. *Journal of Accounting and Economics* (June/September): 119-42.
- Financial Accounting Standards Board (FASB). 1977. *Statement of Financial Accounting Standards No. 19, Financial Accounting and Reporting by Oil and Gas Producing Companies*. Stamford, CT: FASB.
- _____. 1979. *Statement of Financial Accounting Standards No. 33, Financial Accounting and Changing Prices*. Stamford, CT: FASB.
- _____. 1980. *Statement of Financial Accounting Concepts No. 2, Qualitative Characteristics of Accounting Information*. Stamford, CT: FASB.

- _____. 1984. *Statement of Financial Accounting Concepts No. 5, Recognition and Measurement in Financial Statements of Business Enterprises*. Stamford, CT: FASB.
- _____. 1991. *Statement of Financial Accounting Standards No. 107, Disclosures about Fair Value of Financial Instruments*. Norwalk, CT: FASB.
- _____. 1993. *Statement of Financial Accounting Standards No. 115, Accounting for Certain Investments in Debt and Equity Securities*. Norwalk, CT: FASB.
- Flannery, M. J. and C. M. James. 1984. The effect of interest rate changes on the common stock returns of financial institutions. *The Journal of Finance* 39: 1141-52.
- Hansen, L. P. 1982. Large sample properties of generalized method of moments estimators. *Econometrica* 50: 1029-54.
- Harris, T. S. and J. A. Ohlson. 1987. Accounting disclosures and the market's valuation of oil and gas properties. *The Accounting Review* 62 (October): 651-70.
- Haw, I. M. and S. Lustgarten. 1988. Evidence on income measurement properties of ASR No. 190 and SFAS No. 33 data. *Journal of Accounting Research* 26 (Autumn): 331-52.
- Healy, P., S. Kang, and K. Palepu. 1987. The effect of accounting procedure changes on CEO's cash, salary, and bonus compensation. *Journal of Accounting and Economics* 9: 7-34.
- Hopwood, W. and T. Schaefer. 1989. Firm-specific responsiveness to input price changes and the incremental information content in current cost income. *The Accounting Review* 64 (April): 313-28.
- Ibbotson, R. G. and R. A. Sinquefeld. 1991. *Stocks, Bonds, Bills, and Inflation 1991 Yearbook* (SBBI), Chicago, IL: Ibbotson and Associates, Inc.
- Jennings, R. 1990. A note on interpreting "incremental information content." *The Accounting Review* 65 (October): 925-32.
- Jones, J., R. Nachtmann, and F. Phillips-Patrick. 1991. Market value accounting and bank income volatility: Some evidence from the investment account. Working paper. Office of Economic Analysis, U.S. Securities and Exchange Commission, Washington, D.C.
- Kothari, S. P. and R. G. Sloan. 1992. Information in earnings about future earnings: Implications for earnings response coefficients. *Journal of Accounting and Economics*, 15: 143-76.
- Landsman, W. 1986. An empirical investigation of pension fund property rights. *The Accounting Review* 61 (October): 662-91.
- _____, and J. Magliolo. 1988. Cross-sectional capital market research and model specification. *The Accounting Review* 63 (October): 586-604.
- Lipe, R. 1986. The information contained in the components of earnings. *Journal of Accounting Research* (Supplement): 37-68.
- Lobo, G. J. and I. M. Song. 1989. The incremental information in SFAS No. 33 income disclosures over historical cost income and its cash and accrual components. *The Accounting Review* 64 (April): 329-43.
- Magliolo, J. 1986. Capital market analysis of reserve recognition accounting. *Journal of Accounting Research* (Supplement): 69-108.
- Miller, M. H. and F. Modigliani. 1966. Some estimates of the cost of capital to the electric utility industry, 1954-1957. *The American Economic Review* 56 (3): 333-91.
- Murdoch, B. 1986. The information content of FAS 33 returns on equity. *The Accounting Review* 61 (April): 273-87.
- Ohlson, J. A. 1989. Accounting earnings, book value, and dividends: The theory of the clean surplus equation (part 1). Working paper. Columbia University. New York, NY.
- _____, and S. H. Penman. 1991. Disaggregated accounting data as explanatory variables for returns. Working paper. Columbia University. New York, NY.
- Scholes, M. S., G. P. Wilson, and M. A. Wolfson. 1990. Tax planning, regulatory capital planning, and financial reporting strategy for commercial banks. *The Review of Financial Studies* 3: 625-50.
- Warfield, T. D. and T. J. Linsmeier. 1992. Tax planning, earnings management, and the differential information content of bank earnings components. *The Accounting Review* 67 (July): 546-62.
- White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48 (May): 817-38.
- White, L. J. 1991. The value of market value accounting for the deposit insurance system. *Journal of Accounting, Auditing, and Finance* 6 (Spring): 289-302.

Incentives and Disincentives for Financial Disclosure: Voluntary Disclosure of Defined Benefit Pension Plan Information by Canadian Firms

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SYNOPSIS AND INTRODUCTION: Understanding managers' incentives to disclose information voluntarily has been described as "the quintessential accounting problem" (Verrecchia 1990a, 245). In contrast to economic consequences (positive) theories, Leftwich (1990, 41) states that "there are few empirical investigations of the effect of an information role on accounting choice" and that "information economics has yet to yield a set of empirically testable propositions." This study addresses this empirical deficiency by testing hypotheses developed from two disclosure theories by examining Canadian firms' voluntary disclosure of defined benefit pension plan (DBPP) information.

First, Verrecchia's (1983) proprietary cost theory states that the incentive to disclose information is a decreasing function of the potential proprietary costs attached to a disclosure and an increasing function of the favorableness of the news in a disclosure. Second, Diamond (1985) explains firms' voluntary disclosures through information cost savings. He shows that if a firm commits to a policy of disclosing relevant information, it will preempt investors' private information search activity. This provides a pareto improvement through lower overall information production costs.

This study demonstrates the proprietary cost implications and valuation relevance of pension disclosures and then develops hypotheses and empirical surrogates for proprietary costs and private information acquisition cost savings in this setting. The results are consistent with the proprietary cost theory but are equivocal with respect

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to the information cost savings hypothesis. Proprietary costs mitigate the adverse selection argument in favor of full disclosure; moreover, the disclosures are conditioned on the favorableness of the news. Proxies representing proprietary costs related to labor are negatively associated with firms' DBPP disclosures.

Key Words: *Defined benefit pension plans, Disclosure, Proprietary costs.*

Data Availability: *Data were obtained from public sources and are available on request from the author.*

THE paper proceeds as follows. Section I presents the disclosure hypotheses after reviewing the theoretical antecedents and demonstrating why the Canadian pension disclosures provide an appropriate venue to examine these issues. Section II describes the sample and develops proxies. Section III presents the statistical procedures and primary results. Section IV explores the role that the favorableness of information plays in the disclosure decision. Section V concludes the paper.

I. Development of the Disclosure Hypotheses

Theoretical Background

Seminal work by Grossman (1981) and Milgrom (1981) provides an adverse selection argument for complete disclosure of information relevant to a buyer. If potential buyers know the type but not the content of information held by a seller, then, in the absence of disclosure, the buyers rationally discount the value of the seller's good to the worst case. This imposes a large cost on the seller, who has an incentive to disclose information that is better than the worst case. This should lead to the complete disclosure of all relevant information; however, in practice, firms do not disclose all relevant information. This has motivated theoreticians to consider factors that mitigate the adverse selection argument. Verrecchia (1983) and Dye (1985)¹ produce similar models that emphasize the role of buyers' uncertainty as to the reason management does not reveal the information.

Verrecchia (1983) posits that buyers' uncertainty arises from the potential proprietary costs associated with an information disclosure. A potential proprietary cost is any possible reduction in future cash flows attributable to a disclosure. He provides the following description and example: "the release of accounting statistics about a firm may be useful to competitors, shareholders, or employees in a way which is harmful to a firm's prospects even if (or perhaps because) the information is favorable. One recent example of this is the response of the UAW (United Auto Workers) for fewer labor concessions in the face of an announcement by Chrysler Corporation's chairman that the firm's fortunes had improved" (182). Managers exercise discretion by comparing the costs of disclosing proprietary information against the anticipated drop in firm value based on investors' conjectures about what may be hidden.

Proprietary costs prevent investors from fully discounting share price in the absence of disclosure because they are uncertain whether information is withheld because the news is bad

¹ In Dye (1985), extended by Jung and Kwon (1988), buyers are uncertain whether the manager holds relevant nonproprietary information. This produces a disclosure threshold measured in the favorableness of news and increasing in the probability that managers do *not* hold the information. As described later, it is clear that management has the pension information, and the focus is placed on the uncertainty derived from potential proprietary costs.

or to avoid the realization of the proprietary costs. The resulting discretionary equilibrium or threshold level of disclosure is measured in the favorableness of news and is increasing in proprietary costs. The more favorable the news, the more positive the influence on share price and the greater the incentive to disclose. Conversely, the larger the proprietary costs, the greater the decrease in firm value upon disclosure and the greater the incentive *not* to disclose. In the absence of proprietary costs, *all* relevant news are disclosed²; but as proprietary costs increase, only more favorable news is disclosed. Further, investors will react less negatively to withheld information as proprietary costs increase since the motive for nondisclosure becomes more uncertain. The proprietary cost theory divides into two general hypotheses. First, the probability of a firm disclosing information is negatively associated with the proprietary costs attached to the disclosure, *ceteris paribus*. Second, the probability of a firm disclosing information is positively associated with the favorableness of the news in the disclosure, *ceteris paribus*.³

Diamond (1985) provides a single-period model in a pure exchange economy, whereby firms precommit to a disclosure policy based on information cost savings. Absent disclosure, each investor invests in information prior to a trading period if he can gain a trading advantage. The potential information cost savings are equal to the sum of the individual information production costs. A pareto improvement could be achieved if the investors could agree not to engage in private information production. Since policing this activity would be difficult, the next-best solution has the firm preempt the private production by guaranteeing to produce the information itself. Cost savings arise because the information is collected only once. Firms' disclosures should increase in the level of private information production that would take place in their absence. If no investors produce the information, then there are no potential cost savings and no disclosure will occur.

The Theoretical Perspectives and Canadian Pension Disclosures

The disclosure theories may be tested in a setting where a priori arguments can be made for valuation-relevant information content and the importance of proprietary costs. In this study, the focus is on the election of Canadian companies to incorporate additional disclosures regarding DBPPs into their financial statements. The Canadian standard defining how to calculate pension assets, liabilities, and costs for firms with DBPPs became applicable with the December 31, 1987 fiscal year-end. While the Canadian standard uses similar measurement rules to the U.S. standard to determine pension cost and the projected benefit obligation, the opportunity to investigate voluntary disclosure arises because it features less mandatory disclosures. The Canadian policy mandates note disclosure of only the actuarial present value of projected pension benefits, and the "market-related value" of pension fund assets.⁴ The disclosure of pension cost, actuarial assumptions, and other details is left to the discretion of management.

This setting provides a rich environment to study disclosure and proprietary cost effects because there is evidence that pension information is relevant to investors. Also, firms that are suppressing relevant information can be distinguished from those without such information. This permits a less noisy test of the hypotheses because Dye's (1985) explanation does not apply. This disclosure decision is a strategic one for management because the information is not

² The work of Grossman (1981) and Milgrom (1981) can be seen as the special case where proprietary costs are zero.

³ The hypotheses refer to the probability of disclosure, implying that a higher disclosure threshold translates to a lower probability. Verrecchia (1990b) supports the use of the probability of disclosure

⁴ Market-related value is either market value or a value adjusted to market over a period not to exceed five years. This distinction is disclosed at the discretion of management.

readily available elsewhere. Finally, there are proprietary cost implications. These four advantages are outlined more fully below.

First, pension plan information is valuation-relevant. There is an association between pension information and share prices (Barth 1991; Daley 1984; Feldstein and Morck 1982; Landsman 1986). The values reported for pension assets, liabilities, and costs are very sensitive to the assumptions used and knowledge of these assumptions is important to evaluating the status of DBPPs (Ezra 1979; Skinner 1980; Winklevoss 1977). These concerns helped justify the extensive disclosures mandated in *Statement of Financial Accounting Standards No. 87, Employers' Accounting for Pensions* (SFAS 87, FASB 1985). There has also been political pressure for greater regulation and reporting on pension plans to employees and the public (Clark and McDermid 1990; Finlayson 1989; Nader and Blackwell 1973). In response, government regulators and accounting standard setters have incurred considerable costs to develop both legislation, *Employees Retirement and Security Benefits Act* (ERISA) in the United States and provincial acts in Canada, and accounting standards (SFAS 36, 87, 88 in the United States and section 3460 in Canada) over the past 20 years.

Second, a major difficulty in investigating disclosure is overcome by identifying firms with DBPPs and focusing solely on firms with information.⁵ Firms with DBPPs are identifiable because they had to disclose the pension asset and liability. The voluntary disclosures examined are basic to a pension plan or are required to calculate net income and the pension asset and liability. Thus the sample is composed of unambiguous disclosure and nondisclosure firms.

The Canadian environment satisfies the third requirement that the information is not readily available elsewhere. Canada has no national legislation comparable to ERISA that provides for employee access to plan information. Instead, there are provincial acts of varying scope, many have no disclosure provision, and are subject to ambiguous interpretation and weak enforcement (Finlayson 1989). Further, the accounting information is new information even to employees with access to pension funding information because the latter allows the use of any one of several actuarial methods, uses conservative assumptions rather than the "best estimates" required by the standard, and often excludes salary projection (Ezra 1979, 1983; CICA 1986).

Fourth, there is evidence that DBPP disclosures carry potential proprietary costs. Clark and McDermid (1990) demonstrate that pensions are an important part of the labor contract and have significant implications for firms' competitiveness. A review of the *Public Record of Submissions* (June 1986) to the Accounting Standards Committee of The Canadian Institute of Chartered Accountants supports the relevance of pension plan information for investors and the existence of potential proprietary costs. There were 137 responses: 11 from actuaries, 26 from accounting firms and government auditors, 86 from companies with pension plans, and 14 from others, including financial analysts' associations. Financial analysts favored more disclosure, particularly of pension costs and interest rates. Conversely, 80 percent of the responses from the firms with pension information to report were opposed. The majority (47 firms) of those opposed had favored the status quo in which funding forms the basis for accounting and firms are free to choose among actuarial methods. Many of these firms also opposed the use of salary projection in pension calculations. Thirty firms criticized the modest disclosure provisions that appeared in the exposure draft and, later, in the standard. They argued the disclosures would be prejudicial to their future operations. Twenty-one specifically stated that the disclosures would

⁵ The paper examines the disclosures of firms with DBPPs. The choice of a DBPP versus a defined contribution plan rests on the firm's willingness to bear the investment risk in a DBPP. In return, the firm can limit employee turnover since DBPPs impose a cost on departing employees. The greater prevalence of DBPPs in large firms is consistent with their ability to absorb investment risk. For a thorough analysis, see Clark and McDermid (1990).

undermine future labor relations or wage negotiations, with the greatest concern expressed over wage and interest rate assumptions and pension costs. Concerns over the latter emphasized the differences between the amounts funded under the current conservative actuarial practices and the standard's best-estimate assumptions.

The Hypotheses

Because both proprietary and information acquisition costs are difficult to measure directly, surrogates need to be developed. Section II develops surrogates for proprietary costs using empirical work from labor economics that indicates that the presence of certain characteristics, such as the historical frequency of strikes, reveals the presence of a proprietary cost—the cost of bargaining with aggressive unions—which is then influential in setting a firm disclosure policy when a new accounting rule presents itself. The proprietary cost (PC) hypothesis can be stated as:

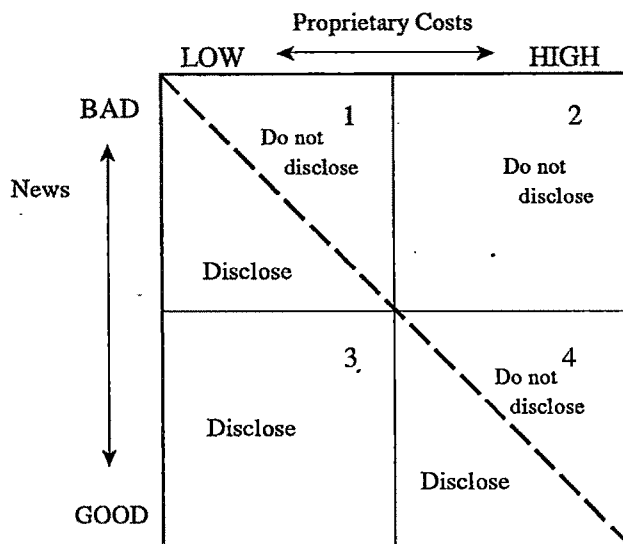
- H1: *Ceteris paribus*, the probability of a firm disclosing pension plan information is negatively associated with the potential proprietary costs attached to its labor relations.

Unfortunately, one can observe news only for the act of disclosing, but not for the nondisclosing firms. Testing H1, without observing the news in the potential disclosure, is feasible as long as news and proprietary costs are not too closely related and the sample is sufficiently large to overcome any attendant noise.⁶ Figure 1 provides a simplified illustration that presents proprietary costs and news orthogonally with firms evenly dispersed across the square. Firms are classified based on low-high proprietary costs and bad-good news. Firms on the diagonal are indifferent to disclosing because the reduction in share price attributable to the proprietary costs of disclosure are equal to the investors' discounting of the share price in the absence of disclosure. Firms below the diagonal disclose because the favorableness of news dominates their proprietary costs, while those above the diagonal do not disclose because proprietary costs outweigh the news. In the absence of a strong correlation between proprietary costs and news, firms with low proprietary costs should disclose more often than firms with high proprietary costs. Given the evenly dispersed set of firms in figure 1, the ratio of low proprietary cost disclosers to high proprietary cost disclosers is 3:1, corresponding to quadrant 3 plus one-half of quadrant 1 versus one-half of quadrant 4. The measurement error induced by not observing news should bias against significant results when testing H1 since some low proprietary cost firms with particularly bad news will not disclose and some high proprietary cost firms with particularly good news will disclose.

Although orthogonality is not required for H1, if there is a very strong association between proprietary costs and news across firms, then the predicted association between proprietary costs and disclosure may not materialize because a disclosure threshold may not exist. For example, if one begins with proprietary costs dominating a disclosure decision, then a strong correlation between news and proprietary costs should discourage firms from ever disclosing since better news is accompanied by higher proprietary costs. The strength of any association between proprietary costs and the favorableness of news will vary across different disclosures. An example of a positive association would be favorable information concerning growth in a firm's product markets that, if disclosed, would induce new competition. This problem is less

⁶ A similar argument can be applied to the test of H2.

Figure 1
Proprietary Costs, the Favorableness of News, and Disclosures



Note: Potential proprietary costs have a lower limit equal to the dissemination costs but no upper bound. News can be increasingly favorable or unfavorable with respect to the price of a firm's securities. The cells are for illustrative purposes only.

obvious for the proprietary costs related to labor; however, if there is a strong association, then it should increase the bias against rejecting the null that proprietary costs are irrelevant.

A similar argument justifies the independent test of the hypothesis that more favorable news increases the probability of disclosure. Since the news can only be observed for disclosing firms, Section IV develops an indirect test that relates the news in the pension cost voluntary disclosure to the disclosure of additional related pension plan details. Specifically, the following hypothesis is tested on the subset of firms disclosing pension cost:

- H2: *Ceteris paribus*, the probability of a firm disclosing additional pension plan details is positively associated with the favorableness of the news in the pension cost disclosure.

Diamond's model implies that firms' disclosures will be increasing in the level of private information production that would take place in its absence. The association between share values and pension information provides a reason for investors to privately acquire pension information and by extension provides the potential for information production cost savings if firms disclose pension information. Section II develops the proxies that are used to test the following information cost saving (ICS) hypothesis:

- H3: *Ceteris paribus*, the probability of a firm disclosing information is positively associated with investors' private information production in the absence of disclosure.

Diamond assumed homogeneous traders with equal information production costs. Hakansson (1977, 1981) considers situations that violate these assumptions and concludes that voluntary disclosures will make individuals with a high cost or informational advantage worse off. Diamond agrees that parties with informational advantages, such as traders owning significant blocks of stock, may attempt to prevent disclosure. This prompts the following hypothesis:

H4: *Ceteris paribus*, the probability of a firm disclosing information is negatively associated with the ownership of significant shareholders.

Information must be relevant to investors' security valuations to prompt managers to consider either proprietary costs or information costs. Under the PC hypothesis, disclosing irrelevant information yields a loss equal to the costs of dissemination. Similarly, for the ICS hypothesis, investors have no incentive to produce irrelevant information. This leads to a fifth hypothesis:

H5: *Ceteris paribus*, the probability of a firm disclosing a piece of information is positively associated with the relevance of the information.

II. The Sample and Development of Variables

The sample was developed by identifying firms with DBPPs from *The Report on Business Top 1000* and the *Financial Post Corporate Data Base*. Firms were discarded if they were wholly-owned subsidiaries, government-owned corporations, or privately held. The remaining 288 firms span a wide range of industries, including mining, manufacturing, retailing, and financial institutions. Disclosures are examined for the first fiscal year for which the new standard is required, December 31, 1987 or 1988 for other fiscal year-ends. All independent variables are measured up to this fiscal year-end and chronologically precede the pension disclosures.

Two disclosure variables are used. The first, labeled *ordinal*, includes interest (and salary) assumptions and pension cost. The second, labeled *plan details*, includes six less important items. The earlier discussion indicates that interest assumptions and pension cost are most important to valuing pension assets and liabilities and most critical to future labor relations. Of the 288 firms, 102 disclosed pension cost and 186 did not. Only 39 firms disclosed interest assumptions; 249 did not. Since 35 firms disclosed both, the disclosure of interest assumptions effectively implies the disclosure of pension cost. This suggests an ordinal variable with both disclosures comprising the highest level and pension cost comprising the intermediate level. Ideally, in an ordinal classification, all firms disclosing interest assumptions would disclose pension cost. Thus, the four outliers are excluded from the test.⁷

Plan details includes six other DBPP items, disclosed in varying frequencies across the sample, that the standard and references suggest are useful. These are: (1) the asset valuation method; (2) the amortization method for plan adjustments; (3) the type of DBPP; (4) who is covered; (5) the investment policy; and (6) the funding policy. There is no obvious order to these details, neither with respect to their relative importance for valuation and proprietary costs nor in terms of any apparent pattern, such as the disclosure of *a* implying anything about the disclosure of *b*. Consequently, the six items are coded as being present (1) or not (0), and then summed. Summation implies a discrete interval scale for plan details ranging from zero to six;

⁷ The results for all observations will be noted, with a dependent variable based on two disclosures being greater than one, and one disclosure being greater than none.

however, if the information conveyed by the details is correlated, then the first detail disclosed will contain the most information, and each successive disclosure will contain less than the prior one, again suggesting an ordinal scale. Exhibit 1 summarizes the dependent variables and also the independent variables that follow

The first three independent variables, strike incidence, payrate, and rate of return on assets (ROA) versus industry, are intended to capture proprietary costs related to firms' labor relations. Labor relations affect firms' cash flows and profitability, and managers believe that pension disclosures contain information that is useful to labor and prejudicial to the firm. The proprietary costs attached to these disclosures should be higher, and therefore there should be less disclosure by firms with a history of poor labor relations or where labor is expected to be more demanding in future wage negotiations.

Strikes are costly to firms (Becker and Olson 1986; Lacroix 1986). Managers of firms with recent strikes should be reluctant to provide labor with information useful for negotiations. *Strike incidence* is measured as the number of strikes each firm had in the three years prior to the disclosure opportunity scaled by the natural log of the number of employees. In labor economics, a scaled strike frequency variable is preferred to either the number of workers involved or days lost in strikes (Franzosi 1989; Lacroix 1986). A three-year period covers the most recent contracts because three years is the most common time span, with few contracts running longer (Lacroix 1986). The strike data were collected from publications of the Canadian Bureau of Labour and similar provincial departments. Strike incidence is positively related to proprietary costs and should be negatively associated with disclosure.

Payrate is the average weekly wage rate for hourly workers. Groshen (1990) and Leonard (1989) provide evidence that higher-paying firms yield smaller increases in future negotiations. Also, higher relative wages are negatively associated with future labor disruptions (Bean and Peel 1974; Shorey 1976; Mauro 1982). Thus, more highly paid employees are less likely to reduce future cash flows through either wage pressures or labor disruptions. While firm-specific wage profiles are not available, Statistics Canada provides wage scales by industry at a two-to-three-digit SIC level of fineness. Payrate is negatively related to proprietary costs and should be positively associated with disclosure.

ROA versus industry is included based on the evidence in Ichniowski and Delaney (1990) showing that labor extracts larger wage concessions from more profitable firms. They document that a poor earnings performance within-industry is associated with relatively lower future wage increases. This suggests that poor profit levels within-industry mitigate future wage pressures, implying lower potential proprietary costs with respect to future negotiations. ROA is defined as earnings before interest and taxes divided by total assets. ROA versus industry is measured as the three-year average ROA divided by the industry (three-digit SIC) three-year average ROA. ROA is preferred to return on equity because the latter can have excessive returns when its denominator is very small. Again, the three-year time period is consistent with typical labor contracts. ROA versus industry is positively related to proprietary costs and should be negatively associated with disclosure.⁸

The association between share values and pension information implies investors will attempt to gather pension information, allowing a test of the ICS hypothesis. Although individual information production costs may vary among investors, fundamentally, information cost savings are an increasing function of the number of investors seeking information. The ICS hypothesis is consistent with empirical observations (summarized in Ball and Foster 1982)

⁸ An alternate interpretation, consistent with the PC hypothesis, is that a high within-industry ROA indicates a competitive advantage. Such firms will try to keep secret their cost functions, including pension costs.

Exhibit 1
Summary of the Disclosure and Explanatory Variables

Dependent Pension Disclosure Variables:

Ordinal = (2,1,0) pension cost and interest assumptions both disclosed (2); only pension cost disclosed (1); neither disclosed (0)

Plan Details = ranges from zero to six, each disclosure of one of six plan details adds one to the total

Independent Variables:

1) Proprietary Costs

Strike Incidence (-) = number of strikes over prior three years scaled by the natural log of the number of employees

Payrate (+) = average weekly pay for hourly workers in industry during year prior to disclosure

ROA versus Industry (-) = average return on assets (earnings before interest and taxes/total assets) for the firm divided by its industry average return on assets for the three years prior to disclosure

2) Information Costs

Trading Volume (+) = annual trading volume divided by the number of shares outstanding during fiscal year prior to disclosure

Public Issue (+) = number of public issues in the capital markets for three years prior to the disclosure

Significant Owners (-) = percentage of total common voting stock held by significant owners (>10%) at fiscal year-end prior to disclosure

3) Information Relevance

Materiality (+) = ratio of the greater of plan assets or plan liabilities to total assets at fiscal year-end prior to disclosure

4) Control Variables

SEC Listing (+) = (1,0) firms required to file with the SEC (1), otherwise (0)

Size (+) = log of firm sales

Note: The sign enclosed in parenthesis to the immediate right of each independent variable is the predicted sign for that variable in an ordinal logistic regression.

that firm disclosures are positively associated with firm size. There are two reasons that firm size is not used as a proxy for the ICS hypothesis. First, alternative explanations (Leftwich et al. 1981; Watts and Zimmerman 1986) exist for a positive association between size and disclosure; thus a positive association cannot be interpreted unambiguously. Second, it is appropriate to bias against rejecting the null hypothesis of no influence. While interpreting size is problematic, it must, however, be included as a control because of its demonstrated association with disclosure. Size is measured by the natural log of the firm's sales. Thus, the variables introduced below, trading volume and public issue for H3, and significant owners for H4, are limited to capturing the marginal influence of these hypotheses beyond the effect of size.⁹ This constitutes a rigorous test of the ICS hypothesis since the bias is against its acceptance.

Trading volume is the firm's relative trading volume measured as the annual trading volume¹⁰ divided by the number of shares outstanding. Presumably, at least some traders are trading on and generating information rather than trading purely for liquidity purposes.¹¹ Trading volume is an index of private general information production that is assumed to be correlated with the private production of specific pieces of information such as pension information. Firms should react to the opportunity provided by the new pension standard to reduce private information production costs through disclosure. Although absolute trading volume is probably a better indicator of the number of investors seeking information, it is not used because it correlates significantly with size.

Shores (1990) finds a similar variable is positively associated with the level of interim information reflected in the market prior to an earnings announcement.¹² Shores' finding is consistent with that of Grossman and Stiglitz (1976) suggestion that trading should partially reveal private information. If it is costly for investors to produce private information, then firms' voluntary disclosures can generate information cost savings. Since information cost savings are proportional to trading volume, it should be positively associated with firms' voluntary disclosure of pension information.¹³

Public issue is a dichotomous variable that records whether a firm made a public issue in any of the three prior fiscal years. Firms that increase the number of their securities traded in secondary markets should prompt an increased (or at least nondecreasing) demand for information. Public issue should be positively associated with disclosure.

Significant owners is measured as the percentage of a firm's voting common stock held by large shareholders. Shareholders holding 10 percent or more of a firm's common voting stock were identified for all firms from Ontario Securities Commission filings and Statistics Canada

⁹ The variables' influence in the absence of the control variables and the use of absolute rather than relative trading volume will be discussed.

¹⁰ For most firms this is taken from the Toronto Stock Exchange, but for a few firms it is from the Montreal Exchange.

¹¹ This variable presumes the liquidity traders are randomly distributed, so that the variable captures the influence of the information traders.

¹² There is a distinction between the level of information reflected in prices and the marginal incentive to invest in private information. Trading volume is associated with the former. It is composed of the trades of investors whose decision to invest in information reflects the marginal benefit at the time. Trading activity results in more information in the market price, and the marginal return to information search for the next trader is diminished. Presumably, the passage of time renews the incentive to acquire new information.

¹³ Canadian regulations require less public disclosure of equity ownership and investor participation than in the United States. Two variables that might capture potential information cost savings, had American regulations applied, are the number of shareholders or the number of analysts following a stock.

intercorporate ownership data. Significant owners should be negatively associated with disclosure.¹⁴

All the hypotheses are contingent upon the pension information being relevant or material to the valuation of the firm. The more material the plan, the greater the probability of disclosure (H5). Materiality is measured by dividing the larger of the plan assets or the plan liability by total assets. This measure does not presuppose any particular income effect or funding status since it does not contrast plan assets and liabilities.¹⁵

Some of the firms list securities in the United States. The American pension standard SFAS 87 (FASB 1985) requires disclosure of many items that are voluntary under the Canadian standard. Although firms with non-American plans had a grace period and did not have to report to the Securities and Exchange Commission (SEC) for the fiscal year tested, some managers may have considered it in their firms' interests to cooperate with the SEC by disclosing the pension information. Thornton (1986) reports that SEC-listed Canadian firms' were more likely to voluntarily disclose information on accounting for changing prices, but that this does not guarantee that disclosure will take place. Thus, SEC listing is introduced as a control variable.¹⁶

III. Results for the Hypotheses on Proprietary Costs and Information Cost Savings

Table 1 presents correlations among the independent variables and collinearity diagnostics (Belsley et al. 1980). All variance inflation factors and condition numbers are well below the suggested guide of 10, indicating that collinearity among these variables is not a problem.

Table 2 presents ordinal logistic regressions, with predicted signs, parameters, asymptotic t-statistics, a chi-square statistic, and three classification rates: the within-sample classification, the jack-knife classification making an out-of-sample prediction for each observation, and the paired rank correlation classification compares all differing pairs of observations and classifying them as concordant if the higher level response has a higher predicted probability than the lower level response. The last classification uses the entire distribution of probabilities and is closer to a goodness-of-fit test.

The results indicate that the model of disclosure from exhibit 1 has significant explanatory power for both DBPP disclosures. Both chi-squared statistics are highly significant. The classifications are superior to a naive classification based on the largest cell, even for the out-of-sample jack-knife classification.¹⁷

All the variables representing the PC hypothesis have the predicted signs and are generally significant. *Strike incidence* and *payrate* are significant for *plan details*, while *payrate* and *ROA versus industry* are significant for *ordinal*.¹⁸ The three PC variables' incremental contribution

¹⁴ Leftwich et al. (1981) make a similar prediction based on disclosure qua monitoring being less important if ownership is tightly held.

¹⁵ A DBPP need not be material to valuation for proprietary costs to exist. For example, a small DBPP applicable only to a firm's executives could have little valuation relevance; however, disclosure of executives' expected pay increases could be used in future wage negotiations. Jensen and Murphy (1990, 254) similarly suggest that mandated disclosure of executive salaries is costly because it "provides emotional justification for increased union demands."

¹⁶ In fact, several firms making incomplete disclosures with the SEC did so in later years as well as the year in question.

¹⁷ An ordinal logistic regression does not allow the slopes of the independent variables to vary between pension cost and interest assumptions. Separate logistic regressions relax this restriction and provide qualitatively similar results.

¹⁸ Substituting different formulations for payrate and ROA versus industry produce qualitatively similar results. For payrate, substitutions include: the industry's overall average and unionized pay rate, as well as controlling for the percentage of unionized workers. For ROA versus industry, substitutions (all measured relative to industry) include: a one-year ROA, truncated versions of the one and three-year ROA, a dichotomous variable set to one if a firm's ROA exceeded the industry in each of the prior three years, and similar formulations for return on equity.

Table 1
Collinearity Diagnostics and Correlations Among the Independent Variables

Collinearity Diagnostics*				Pairwise Correlation Coefficients							
Variables	Variance Inflation	Eigen-value	Condition Number	Strike Incidence	Payrate	ROA vs. Industry	Trading Volume	Public Issue	Signif. Owners	Materiality	SEC Listing
Strike Incidence	1.04	1.79	1.00	1.00	—	—	—	—	—	—	—
Payrate	1.22	1.35	1.14	-0.04	1.00	—	—	—	—	—	—
ROA versus Industry	1.03	1.23	1.22	-0.02	0.12 ^b	1.00	—	—	—	—	—
Trading Volume	1.04	0.94	1.39	0.03	-0.05	0.02	1.00	—	—	—	—
Public Issue	1.28	0.89	1.40	0.08	0.02	0.03	0.14 ^b	1.00	—	—	—
Significant Owners	1.09	0.84	1.47	0.02	-0.03	-0.03	-0.09	-0.20 ^a	1.00	—	—
Materiality	1.11	0.80	1.32	0.02	0.08	-0.08	-0.09	-0.16 ^a	0.02	1.00	—
SEC Listing	1.19	0.70	1.56	-0.02	0.22 ^a	0.03	0.06	0.17 ^a	-0.02 ^a	-0.01	1.00
Size	1.46	0.41	2.05	0.16 ^a	-0.24 ^a	-0.07	0.11	0.36 ^a	-0.16 ^a	0.13 ^b	0.22 ^a

*Calculated as per Belsley et al. 1980

^a<0.01^b<0.05

Table 2
Ordinal Logistic Regressions for Pension Disclosures

<i>Independent Variable</i>	<i>Expected Sign</i>	<i>Ordinal</i>	<i>Plan Details</i>
Strike Incidence	(-)	-2.25 (-1.54)	-2.06 ^b (-2.81)
Payrate	(+)	1.14 ^b (2.92)	0.66 ^c (2.15)
ROA versus Industry	(-)	-0.0133 ^b (-2.18)	-0.00207 (-0.77)
Trading Volume	(+)	0.26 (1.28)	0.0193 (0.10)
Public Issue	(+)	0.08 (0.75)	0.15 (1.60)
Significant Owners	(-)	-0.00834 ^c (-1.66)	0.00422 (0.53)
Materiality	(+)	1.19 (1.16)	1.98 ^b (2.33)
SEC Listing	(+)	2.76 ^a (6.27)	1.88 ^a (5.22)
Size	(+)	0.25 ^b (2.41)	0.18 ^b (2.23)
Chi-Square, Sig. Level		96.3, 0.0001	66.9, 0.0001
Within-Sample Classification Rate		70.4%	35.8%
Jack-knifed Classification Rate		70.8%	33.3%
Paired Rank Correlation		72.0%, 0.0001	62.8%, 0.0001
Classification Rate, Sig. Level			

Dependent Variables

Ordinal = 2 pension cost and interest assumptions disclosed	35
= 1 only pension cost disclosed	67
= 0 neither disclosed	182
	N = 284

Plan Details ranges from zero to six, with one count for each of six plan details disclosed
(N = 288)

Notes: The intercept terms are omitted. Asymptotic t-statistics are in parentheses. Firms classified as correct in the within-sample and jack-knife classifications have their highest predicted probability match their actual disclosure choice. A naive prediction rate based on choosing the largest cell is 64.1% for ordinal and 30.9% for plan details. The paired rank classification matches all pairs of observations with different responses and indicates the percentage of times that the higher level response has a higher predicted probability than the lower level response. One-tailed significance levels are: a<0.001, b<0.01, c<0.05.

can be measured by the change in the chi-squared statistic of fitting the logistic regression with only the two control variables, from one including the PC variables and the control variables. They are collectively incrementally significant for both ordinal ($p < 0.001$) and plan details ($p < 0.004$). The variables representing the ICS hypothesis are generally insignificant.¹⁹ Thus, only the PC variables are associated with reductions in disclosures. The absolute level of disclosure also supports the PC hypothesis. Consistent with the concerns expressed by firms to the standard setters, only a small percentage voluntarily disclosed interest information (13.5%) or pension costs (35.3%).

As discussed earlier, an association between size and voluntary disclosures is consistent with the ICS hypothesis. If the two control variables are omitted, then the three ICS variables become more significant in the predicted direction. *Public issue* is significant ($p < 0.01$) for both disclosure variables; *significant owners* is significant for ordinal ($p < 0.01$); and *trading volume* is marginal for ordinal ($p < 0.07$). If absolute trading volume is substituted for relative trading volume in the absence of the control variables, it is significant ($p < 0.01$) for both disclosure variables. These results provide weak support for the ICS hypothesis.

The materiality variable has the predicted sign for both disclosure variables and is significant for plan details. Firms with plans that are large relative to the firm's total assets are more inclined to disclose pension plan information.

IV. Testing the News Hypothesis of the Proprietary Cost Theory

The news hypothesis is an indirect test that uses the news in the pension cost disclosure to explain the disclosure of plan details for the 102 firms disclosing pension cost. The validity of this approach rests on an acceptable measure of the news in pension cost and a sufficiently strong relationship between the pension cost and plan details disclosures, such that disclosure of the latter can be conditioned on the news in the former.

There is empirical support for pension cost containing news relevant to investors. In addition to the current service cost, pension cost aggregates information concerning amortizations arising from the difference between plan assets and the accrued obligation, experience gains and losses, plan amendments, past service costs, and other adjustments. Daley (1984) demonstrates that the market value of a firm's equity is inversely associated with a scaled measure of a firm's pension cost; a lower pension cost is associated with a higher valuation.²⁰ The proprietary cost theory defines news in terms of valuation relevance; therefore, lower pension costs would be *ceteris paribus* good news.

Testing the news in pension cost indirectly on the disclosure of plan details is a noisy alternative to testing the influence of the news in pension cost on the disclosure of pension cost itself. One would prefer to test the hypothesis that "managers are more inclined to disclose information if the news in that information is favorable" rather than the news hypothesis tested here that "managers are more inclined to disclose information if the news in a closely related piece of information is favorable." If the disclosures of pension cost and plan details are linked, then managers may condition the provision of the additional information in plan details on the news in pension cost. In this case, there is a strong link. Firms disclosing pension cost disclose 1.28 additional plan details, on average. This difference is significant at the 0.0001 level.

¹⁹ Measuring public issue as an issuance in the prior year or two years or the total number of issuances in the prior three years does not qualitatively alter the results. Similarly, using the percentage owned by the largest shareholder does not alter the results for significant owners.

²⁰ Ezra (1979), Skinner (1980), and Scott (1991) provide evidence that changes in assumptions, funding methods, or asset returns produce significant differences in pension costs among firms. The good news interpretation implies that lower pension costs predominantly reflect these factors and are not offset by higher wages.

The variable *news* is defined as the ratio of pension cost to the size of the pension plan, where size is measured as the larger of plan assets or liabilities. The lower the ratio, the better the news. News should be negatively associated with the disclosure of plan details for the subset of firms disclosing pension cost.²¹ For purposes of comparison, the original independent variables are presented in column 1 of table 3; then news is included in column 2. Since this subset includes only the firms that disclosed pension cost, these firms have significantly higher levels of disclosure of plan details than the rest of the sample firms, and accordingly these firms also have lower proprietary costs, are larger, and are more likely to be SEC-listed. Therefore, the explanatory power of the original independent variables is likely to be quite different for this subset.

Table 3 indicates that news is highly significant ($p < 0.002$). The classification rates in column 2 are improved over column 1.²² Clearly, news is an important addition to the other explanatory variables. As expected, the significance levels of the other variables are very different. In addition to news, only the SEC variable and the public issue variable are significantly associated with the disclosure of plan details. Collinearity diagnostics for the independent variables, including news, are similar to those presented in table 1. The evidence supports H2, that the probability of disclosure of plan details is increasing in the favorableness of the news in pension cost.

V. Conclusion

The results support both aspects of Verrecchia's proprietary cost model. Proprietary costs mitigate the adverse selection argument in favor of disclosure, and disclosures are conditioned by the favorableness of news. The variables representing the potential effect of proprietary costs are generally associated with a reduction in the sample firms' relative propensity to disclose pension information. Further, an analysis of the disclosure of other plan details based on the news in the pension cost disclosure provides results consistent with more favorable news leading to greater disclosure.

A caveat is that the sample is selected based on the existence of defined benefit pension plans, and the subset used to test news consists of the firms that disclose pension cost. Thus, the generalizability of these results is a concern, although there is nothing in the design of the subset that would appear to increase the probability of rejecting the null that news is irrelevant to disclosure. With respect to the proprietary cost hypothesis, it is possible that the proxies are capturing some omitted factor. Mitigating this concern is the fact that the hypothesis is supported by all three proxies across different formulations, as well as the use of control variables.

The results for the information cost savings hypothesis provide, at best, only modest evidence for its validity. The information cost savings hypothesis is consistent, however, with the observed association between size and disclosure, in that larger firms generally have more investors and by extension have greater potential information cost savings. A better assessment of the interpretation of size may require richer information concerning the composition of firms' owners and their trading behavior.

²¹ Using either plan assets or plan liabilities exclusively in the denominator of news does not qualitatively alter the results that follow.

²² The change in the within-sample and the jack-knifed classification rates from column 1 to column 2 are significant at (< 0.02) and (< 0.01), respectively. The paired rank correlation classifications are improved; however, I am unaware of any comparative test of significance that adequately incorporates the dependence among the pairs.

Table 3
Ordinal Logistic Regressions for Plan Details Excluding (Column 1) and Including
(Column 2) the News Contained in Pension Cost

<i>Independent Variable</i>	<i>Expected Sign</i>	<i>Column 1 Original Variables</i>	<i>Column 2 Including News</i>
Strike Incidence	(-)	1.76 (0.78)	1.11 (0.49)
Payrate	(+)	-0.13 (-0.24)	-0.0181 (-0.03)
ROA versus Industry	(-)	-0.0133 (-1.52)	-0.0121 (-1.38)
Trading Volume	(+)	0.17 (0.83)	0.085 (0.40)
Public Issue	(+)	0.40 ^b (2.68)	0.51 ^a (3.69)
Significant Owners	(-)	0.0108 (0.16)	0.129 (1.89)
Materiality	(+)	2.07 (1.49)	2.10 (1.49)
SEC Listing	(+)	2.73 ^a (4.79)	2.87 ^a (5.03)
Size	(+)	0.0696 (0.50)	-0.0618 (-0.43)
News	(-)	N/A	-15.9 ^b (-3.02)
Chi-Square, Sig. Level		47.9, 0.0001	57.2, 0.0001
Within-Sample Classification Rate		32.4%	41.2%
Jack-knifed Classification Rate		31.4%	42.2%
Paired Rank Correlation		72.0%, 0.0001	74.9%, 0.0001
Classification Rate, Sig. Level			

Dependent Variable
Plan Details ranges from one to six, with one count for each of six details disclosed (N = 102)

Notes: The intercept terms are omitted. Asymptotic t-statistics are in parentheses. Firms classified as correct in the within-sample and jack-knife classifications have their highest predicted probability match their actual disclosure choice. A naive prediction rate based on choosing the largest cell is 28.4%. The paired rank classification matches all pairs of observations with different responses and indicates the percentage of times that the higher level response has a higher predicted probability than the lower level response. One-tailed significance levels are: a<0.001, b<0.01, c<0.05.

References

- Ball, R. J., and G. Foster. 1982. Corporate financial reporting: A methodological review of empirical research. *Journal of Accounting Research* 20 (Supplement): 161-234.
- Barth, M. E. 1991. Relative measurement errors among alternative pension asset and liability measures. *The Accounting Review* 66 (July): 433-63.
- Bean, R., and D. A. Peel. 1974. A quantitative analysis of wage strikes in four U.K. industries. *Journal of Economic Studies* 1 (November): 88-97.
- Becker, B. E., and C. A. Olson. 1986. The impact of strikes on shareholder equity. *Industrial and Labour Relations Review* 39 (April): 425-38.
- Belsley, D. A., E. Kuh, and R. E. Welsch. 1980. *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity*. New York: Wiley.
- CICA (Canadian Institute of Chartered Accountants), Standard Setting Committee. 1986. *Public Record: Pension Costs and Obligations*. Toronto: CICA.
- Clark, R. L., and A. A. McDermed. 1990. *The Choice of Pension Plans in a Changing Regulatory Environment*. Washington, D.C.: AEI Press.
- Daley, L. 1984. The valuation of reported pension measures for firms sponsoring defined benefit plans. *The Accounting Review* 59 (April): 177-98.
- Diamond, D. W. 1985. Optimal release of information by firms. *Journal of Finance* 40 (September): 1071-94.
- Dye, R. A. 1985. Disclosure of nonproprietary information. *Journal of Accounting Research* 23 (Spring): 123-45.
- Ezra, D. D. 1979. *Understanding Pension Fund Finance and Investment*. Toronto: Pagurian Press Ltd.
- _____. 1983. *The Struggle for Pension Fund Wealth*. Toronto: Pagurian Press Ltd.
- Feldstein, M., and R. Morck. 1982. Pension funding decisions, interest rate assumptions and share prices. Working Paper, National Bureau of Economic Research, New York.
- Financial Accounting Standards Board. 1985. *SFAS 87: Employers Accounting for Pensions*. Stamford, CT: FASB.
- Finlayson, A. 1989. *Whose Money Is It Anyway? The Showdown on Pensions*. Markham, Ontario: Penguin Books Canada Ltd.
- Franzosi, R. 1989. One hundred years of strike statistics: Methodological and theoretical issues in quantitative strike research. *Industrial and Labour Relations Review* 42 (April): 348-61.
- Groshen, E. L. 1990. How are wages determined? *Economic Commentary*. Federal Reserve Bank of Cleveland (February 15): 1-4.
- Grossman, S. 1981. The role of warranties and private disclosure about product quality. *Journal of Law and Economics* 24 (3): 461-83.
- _____, and J. Stiglitz. 1976. Information and competitive price systems. *American Economic Review* 66 (2): 246-53.
- Hakansson, N. H. 1977. Interim disclosure and public forecasts: An economic analysis and a framework for choice. *The Accounting Review* 52 (April): 396-416.
- _____. 1981. On the politics of accounting disclosure and measurement: An analysis of economic incentives. *Journal of Accounting Research* 19 (Supplement): 1-35.
- Ichniowski, C., and J. T. Delaney. 1990. Profitability and compensation adjustments in the retail industry. *Industrial and Labour Relations Review* 43 (February): 183S-202S.
- Jensen, M. C., and K. J. Murphy. 1990. Performance pay and top-management incentives. *Journal of Political Economy* 98 (2): 225-64.
- Jung, W., and Y. Kwon. 1988. Disclosure when the market is unsure of the information endowment of managers. *Journal of Accounting Research* 26 (Spring): 146-53.
- Lacroix, R. 1986. Strike activity in Canada. In *Canadian Labour Relations*, edited by W. C. Riddell. Toronto: University of Toronto Press.
- Landsman, W. 1986. An empirical investigation of pension fund property rights. *The Accounting Review* 61 (October): 662-91.

- Leftwich, R. W. 1990. Aggregation of test statistics: Statistics versus economics. *Journal of Accounting and Economics* 12 (January): 37-44.
- _____, R. L. Watts, and J. L. Zimmerman. 1981. Voluntary corporate disclosure: The case of interim reporting. *Journal of Accounting Research* 19 (Supplement): 50-77.
- Leonard, J. S. 1989. Wage structure and dynamics in the electronics industry. *Industrial Relations* 28 (Spring): 251-75.
- Mauro, M. J. 1982. Strikes as a result of imperfect information. *Industrial and Labour Relations Review* 35 (July): 522-38.
- Milgrom, P. 1981. Good news and bad news: Representation theorems and applications. *Bell Journal of Economics* 12 (Autumn): 380-91.
- Nader, R., and K. Blackwell. 1973. *You and Your Pension*. New York: Grossman.
- Scott, T. W. 1991. Pension disclosures under SFAS 87: Theory and evidence. *Contemporary Accounting Research* 8 (Fall): 62-81.
- Shores, D. 1990. Interim information and security returns. *Journal of Accounting Research* 28 (Spring): 164-81.
- Shorey, J. 1976. An inter-industry analysis of strike frequency. *Economica* 43 (November): 349-65.
- Skinner, R. M. 1980. *Pension Accounting: The Problem of Equation Payments Tomorrow with Expenses Today*. Toronto: Clarkson Gordon.
- Thornton, D. B. 1986. Current cost disclosers and nondisclosers: Canadian evidence. *Contemporary Accounting Research* 3 (Fall): 1-34.
- Verrecchia, R. E. 1983. Discretionary disclosure. *Journal of Accounting and Economics* 5 (December): 179-94.
- _____. 1990a. Endogenous proprietary costs through firm interdependence. *Journal of Accounting and Economics* 12 (January): 245-50.
- _____. 1990b. Information quality and discretionary disclosure. *Journal of Accounting and Economics* 12 (March): 365-80.
- Watts, R. L., and J. L. Zimmerman. 1986. *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Winklevoss, H. E. 1977. *Pension Mathematics: With Numerical Illustrations*. Homewood, IL: Richard D. Irwin.

The Accounting Based Valuation of Corporate R&D

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SYNOPSIS AND INTRODUCTION: This article examines whether reported accounting earnings reflect benefits from past research and development (R&D) expenditures and uses the benefits, if any, to estimate the investment value of R&D.

The issue is how to extract realized R&D benefits from income statement numbers and is important given the current accounting policy of expensing R&D as incurred. To the extent that market participants can determine realized benefits and expect these benefits to persist in the future, they will use accounting earnings numbers to value current R&D. This study uses cross-sectional data to estimate a recursive system of two equations: one for earnings and one for valuation. The earnings equation associates earnings with recorded assets, advertising, and R&D expenditures. It extracts realized R&D benefits from reported earnings numbers. The valuation equation relates market values of equity to book values, earnings, and R&D expenditures. It determines how the accounting and R&D numbers are valued in the market. The coefficients derived from these two equations are then used to estimate the investment value of R&D. This system of equations assumes that past R&D generates earnings that create market value.

The results from the earnings model indicate that reported earnings, adjusted for the expensing of R&D, do reflect realized benefits from R&D. On average, a one-dollar increase in R&D expenditures leads to a two-dollar increase in profit over a seven-year period. The results from the valuation model indicate that investors place a high value on R&D investments. On average, a one-dollar increase in R&D expenditure produces a five-dollar increase in market value. This effect of R&D on market values can be separated into an indirect and a direct component. The indirect effect, when R&D outlays affect market values through earnings, is the capitalized value of R&D benefits reflected in earnings and expected to persist, given that R&D is continuous. In contrast, the direct effect reflects new R&D information conveyed directly by R&D variables. On average, the

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indirect effect is much larger than the direct effect, implying that R&D information conveyed by earnings numbers is more valued than the information conveyed by the R&D variables themselves. Finally, the study controls for the valuation of R&D tax shields generated when firms expense R&D for tax purposes, and/or qualify for the R&D tax credit. The tax shields are found to be relevant and are valued as earnings.

Key Words: *Valuation of R&D, Realized R&D benefits, Valuation models, Earnings models.*

Data Availability: *Data used in this study were obtained from public sources. A list of sample firms is available from the author upon request.*

THE remainder of this article is organized as follows. Section I reviews previous research on R&D valuation and indicates how this article contributes to the literature. Section II presents the theoretical framework employed; section III discusses the data and econometric issues involved; section IV presents the empirical findings; and section V summarizes the findings.

I. Related Previous Research

Earlier work by Johnson (1967), Newman (1968), and Milburn (1971) used cross-sectional correlation and regression analysis, but detected no significant relationship between R&D and future benefits. These results may be attributed to the small sample sizes, the research design and econometric techniques, and the quality of the R&D data used. Other studies such as Ben-Zion (1978), Griliches (1981), Hirschey (1982), Hirschey and Weygandt (1985), and Shevlin (1991), concentrated on demonstrating that R&D is an intangible asset and found a significant relationship between market values and R&D expenditures with parameter estimates ranging from two to eight. This finding has been used to support the argument that capitalization of R&D expenditures and amortization over an extended period of time would be a more appropriate accounting rule than immediate expensing.

These earlier studies did not examine the valuation of R&D tax shields. The expensing of R&D for tax purposes (since 1954) and the R&D tax credit (since 1981) give rise to R&D tax shields that provide incentives to invest in R&D and seem to be permanent. Scholes and Wolfson (1992) point out that prices of tax-favored investments increase by the present value of the tax savings, less the anticipated costs that result from higher demand (e.g., labor and equipment costs, etc.) for such investments.¹ Thus, R&D tax shields must be value-relevant. If the R&D variable is highly correlated with the R&D tax-shield variable and if the two variables are valued differently, then the failure to control explicitly for the tax-shield variable results in the problem of correlated omitted variables.²

¹ Although R&D factor costs will increase due to higher demand for R&D investments, a successful R&D firm can also erect barriers to entry and extract monopoly profits, thus effectively offsetting higher factor costs. Overall, with continuous reinvestment in R&D, a firm will perpetuate the generation of tax shields, which can then be seen as the government's contribution to increased future earnings due to R&D today. These features differentiate R&D tax shields from other tax benefits that a firm earns. Furthermore, the R&D tax shield should be value-relevant even when the firm's current R&D is not successful. If the firm generates taxable income from prior technology or from other sources then the value of its current R&D might well be zero; but the expensing of R&D expenditures will still reduce taxes.

² One can argue that a high correlation between the two variables may induce multicollinearity in the regression estimation. However, multicollinearity inflates standard errors; it does not bias the estimated coefficient. Further, no significant multicollinearity was detected when the tax-shield variable was added.

This article separates the valuation of R&D tax shields from the investment value of R&D and examines the R&D benefits reflected in earnings and their role in determining the investment value of R&D.

II. The Theoretical Framework

The Earnings Equation

Prior work by Grabowski and Mueller (1978) and Ravenscraft and Scherer (1982) demonstrates that investment in both real and intangible assets determines profitability. The real assets consist of fixed assets, inventories, recorded intangibles, and other investments and are measured by the sum of the book value of these items and defined as the net capital stock of the firm. The intangible assets consist of advertising and R&D assets. Due to the expensing rule, these intangible assets are not reported in the corporate balance sheet and must be estimated. The estimation is generally based on current and past advertising and R&D expenditures, because the unamortized portions of these expenditures give rise to capital stocks. Because prior work over all industries has consistently documented the short-lived effect from advertising expenditures (see Ravenscraft and Scherer 1982; Bublitz and Ettredge 1989), this study includes only current advertising expenditures.³ Thus, the earnings equation used is

$$AX_t = \alpha_1 NC_t + \alpha_2 M_t + \sum_{\ell} \alpha_{3,\ell} V_{t-\ell}, \quad (1)$$

where AX_t is after-tax earnings before expensing advertising and R&D expenditures at time t ; NC_t is the net capital stock at time t ; M_t is advertising expenditures at time t ; $V_{t-\ell}$ is R&D expenditures at time $t - \ell$; and the α s are regression parameters.

The adjustment of earnings in equation (1) for the expensing of both current advertising and R&D expenditures is required in order to avoid including them in both sides of the equation: as components of earnings and as independent variables. Thus, α_1 is the *net* after-tax benefit from a dollar investment in real assets. It is a net value because the related costs of acquiring those assets (e.g., depreciation) are included in AX_t . However, α_2 and $\alpha_{3,\ell}$ are the *gross*, after-tax benefits from a dollar investment in advertising and R&D, respectively, because the costs of advertising and R&D are not included in AX_t (given the adjustment made). In particular, $\alpha_{3,\ell}$ is interpreted as the gross, after-tax, realized marginal benefit at time t from a dollar invested in R&D at time $t - \ell$. The sum of the R&D parameters,

$$\sum_{\ell} \alpha_{3,\ell}$$

is the gross, after-tax realized *total* benefit over the period $t - \ell$ to t from a dollar investment in R&D at time $t - \ell$. Alternatively,

$$\sum_{\ell} \alpha_{3,\ell},$$

is the long-run effect of R&D investment on earnings.

³ Industry specific studies have detected long-lived effects from advertising in some industries. For example, Abdel-khalik (1975) found long-lived effects in the food and drug and cosmetics industries, but not in soap and cleansers or tobacco. Since this study uses samples similar to those used in Ravenscraft and Scherer (1982) and Bublitz and Ettredge (1989), eliminating the lagged advertising variables should not result in any significant bias on the estimated parameters given the short-lived effects of advertising documented in these studies. In addition, using lagged variables for both advertising and R&D expenditures greatly reduced sample sizes, largely because the advertising numbers were missing from the data.

The Valuation Equation

This article follows Brennan's (1991) encouragement and utilizes an accounting-based asset valuation model recently developed by Ohlson (1989). Ohlson demonstrates that the clean surplus equation allows the representation of a firm's market value of equity as a function of book value of equity and earnings. In addition, Ohlson allows the presence of "other" value-relevant variables in the valuation function. Such variables, not specifically identified in his analysis, will be value-relevant if their impact has not yet appeared in either book value or earnings.

Ohlson derives the following valuation equation:

$$P_t = Y_t + \beta[X_t - rY_{t-1}] + \gamma * Z_t, \quad (2)$$

where P_t is the market value of the firm's stock at time t ; Y_t is the book value of equity at time t ; X_t is reported accounting earnings at time t ; r is the risk free interest rate; $[X_t - rY_{t-1}]$ is defined by Ohlson as abnormal earnings; Z_t is a vector of other information variables at time t ; and β, γ are valuation parameters. If earnings and book values are sufficient to value the firm, then $\gamma = 0$, otherwise $\gamma \neq 0$.

The Valuation Equation and R&D Accounting

In 1974 the FASB Statement No. 2 mandated the immediate expensing of R&D expenditures. As a result, reported accounting earnings may be written as

$$X_t = (X_t^B - V_t)(1 - \tau_t) = X_t^B(1 - \tau_t) + V_t\tau_t - V_t, \quad (3)$$

where X_t^B is earnings before expensing R&D expenditures at time t ; V is R&D expenditures at time t ; and τ_t is the firm's tax rate at time t .

The analysis in this article focuses on disaggregating R&D from earnings to reveal how the R&D component of earnings is valued.⁴ Further, under an accounting policy of capitalization, the book value of equity would include an R&D capital component and earnings would include an R&D expense component, both of which would be functions of current and past R&D expenditures.⁵ In valuation studies conducted by Cockburn and Griliches (1988) and Hall (1988), the R&D capital variable was found to have a significant coefficient with a value close to 1. This implies that lagged R&D expenditures can be value-relevant, on average. Given the current practice of expensing R&D and the consequent absence of R&D capital and expense variables, current and lagged R&D expenditures need to be included in the valuation equation. Thus equation (2) becomes

$$P_t = Y_t + \beta_1[X_t^B(1 - \tau_t) - rY_{t-1}] + \beta_2[V_t\tau_t] + \sum_{\ell=0}^n \beta_{3,\ell}V_{t-\ell}. \quad (4)$$

⁴ Although earnings can be further disaggregated, it is not pursued in this study because the objective here is to separate the valuation of the R&D tax-shield from the after-tax investment value of R&D, not to determine the valuation of tax shields arising from such tax deductible expenses as salaries and depreciation.

⁵ It is interesting to note that when NBER researchers created the R&D master file in order to study the productivity of publicly traded U.S. manufacturing firms, they included in the file an R&D capital variable (see Hall et al. 1988).

This is a more general model than those used in prior research into R&D since it includes book values of equity, earnings, and current and lagged R&D variables. An R&D firm employs two types of capital: tangible and intangible. In equation (4), β_1 indicates the rate at which realized benefits are valued. The variable $X_t^B(1-\tau_t)$ measures the *net* benefits from tangible capital because the accounting cost of that capital is deducted as depreciation expense from gross margin (profit). However, $X_t^B(1-\tau_t)$ measures the *gross* benefits from R&D capital because under SFAS2, the accounting cost of that capital is not deducted as R&D amortization expense from gross margin. The lagged book value variable, Y_{t-1} , is required to determine the abnormal earnings of the firm in equation (4). The variable $V_t\tau_t$ represents the tax shield from expensing R&D, and β_2 indicates the rate at which R&D tax shields are valued. Current investment in R&D, V_t , may convey new information about the firm's R&D. If investors expect the new R&D investment to generate future benefits *different* from those reflected in the earnings variable $X_t^B(1-\tau_t)$, they will value it accordingly. The valuation parameters, $\beta_{3,\ell}$, in this case, capture not only the expected benefit not reflected in earnings but also the cost of R&D that is excluded from the earnings variable $X_t^B(1-\tau_t)$. Thus,

$$\sum_{\ell=0}^n \beta_{3,\ell}$$

can be positive, negative, or zero. The problem of underidentification also arises since the cost and benefit components of $\beta_{3,\ell}$ cannot be estimated separately. However, since the regression coefficients in equation (4) capture marginal valuation effects, it is apparent that the R&D cost reflected in $\beta_{3,\ell}$ is the dollar invested in R&D.⁶

The after-tax investment value of R&D or, equivalently, the total effect of R&D investment on market price, is given by the total derivative of P_t , less tax shields, with respect to current and lagged R&D variables.

$$\begin{aligned} \frac{dP_t}{dV} &= \frac{\partial P_t}{\partial [X_t^B(1-\tau_t)]} \frac{d[X_t^B(1-\tau_t)]}{dV} + \sum_{\ell=0}^n \frac{\partial P_t}{\partial V_{t-\ell}} \\ &= \beta_1 \frac{d[X_t^B(1-\tau_t)]}{dV} + \sum_{\ell=0}^n \beta_{3,\ell}, \end{aligned} \quad (5)$$

where V is the vector of relevant current and lagged R&D expenditures $V_0, V_1, \dots, V_n$.

⁶ Thus, $\sum_{\ell=0}^n \beta_{3,\ell} = \sum_{\ell=0}^n K_{t-\ell} - 1$, where $\sum_{\ell=0}^n K_{t-\ell}$

is the present value of expected future cash flows from an R&D outlay of one dollar appropriately distributed over the investment horizon ℓ , $\ell = 0, 1, \dots, n$. This is consistent with capital budgeting theory in which the dollar invested is subtracted from the present value of the future benefits to arrive at the net present value of the investment. Two alternatives are the nondisaggregation of earnings and the estimation of an R&D expense variable. Under the first alternative, the expensing of current R&D expenditures can be assumed to be a proxy for R&D expense (accounting cost of R&D). However, without disaggregation, the R&D variable will enter into the model both as an independent "other information" variable and as a component of earnings. Estimation of the nondisaggregated model is problematic because it imposes different valuation parameters on the same variable, implies that V_t is valued as earnings, and can induce spurious correlation. Under the second alternative, the estimation of an R&D expense variable would require estimation of R&D amortization rates, estimation of R&D capital, and appropriate adjustments on earnings and book values of equity. However, this would take the study away from its objective and would imply that investors cannot value a firm's R&D without the presence of an accounting cost measure (R&D expense). Obviously, it is of interest to learn how investors carry out this valuation in the presence of the expensing rule for R&D.

The total derivative of $X_t^B(1 - \tau_t)$ with respect to V is the total (long-run) effect of R&D investment on earnings. The term

$$\beta_1 \frac{d[X_t^B(1 - \tau_t)]}{dV}$$

is the indirect effect of R&D on price through earnings, while the term

$$\sum_{\ell=0}^n \beta_{3,\ell}$$

is the direct effect of R&D on price. Intuitively, the indirect effect is the capitalized value of realized R&D benefits reflected in earnings and expected to persist in the future. The capitalization is at the rate of β_1 which should, theoretically, be greater than one if these benefits have permanent components. The persistence of these benefits in the future derives from the fact that R&D is a continuous process. The direct effect applies to expected R&D benefits, less costs, not reflected in earnings and thus captured directly by the R&D variables. While β_1 and

$$\sum_{\ell=0}^n \beta_{3,\ell}$$

can be estimated from the valuation equation, the total effect of R&D investment on earnings

$$\frac{d[X_t^B(1 - \tau_t)]}{dV}$$

must be taken from the earnings equation (1). The total effect of R&D on earnings is measured by

$$\sum_{\ell}^n \alpha_{3,\ell}.$$

III. Data and Econometric Issues

Data

This study uses data from the 1989 COMPUSTAT annual and research files, the NBER RND-PANEL data set, and the CRSP monthly files of NYSE and AMEX stock returns. During the period 1975 to 1985 firms were required to disclose, measure, and account for R&D expenditures in accordance with SFAS2, introduced in 1974. This means that the relevant data is available and consistent over the eleven-year period.⁷ The analysis stops in 1985 because the NBER data set available has data up to that year.

⁷ Note that the disclosure of R&D expenditures was mandated by the Securities and Exchange Commission in 1972. Thus, SFAS2 dealt only with measurement and accounting issues. Before 1975, each firm was free to use its own definition of R&D expenditures. This may affect results based on data from this period. It is interesting to note that although the FASB mandated the expensing of R&D, the definitions of R&D (SFAS2 paragraphs 8, 9, & 10) indicate that the measurement is directed to capture investments and not expenses. This distinction is important in this study given the causality assumptions made in the earnings and valuations equations. For example, if development costs include the cost of preparing to introduce new products, the interpretation of the R&D coefficients would change in both equations.

The data needed to estimate the earnings equation (1) were obtained from the RND-PANEL data set, which consists of firms engaged in R&D as described in detail in Hall et al. (1988).⁸ The net capital stock variable is measured as the sum of the inflation-adjusted, net book value of property, plant, and equipment; the inflation-adjusted book value of inventories; and the inflation-adjusted book value of recorded intangibles and other investments. The lagged R&D variables are adjusted to current values using the R&D deflator given in Hall et al. (1988). Since the study uses lagged R&D variables, firms with large mergers during the lag period were excluded from the samples.⁹

The accounting data needed to estimate the valuation equation (4) were obtained from the COMPUSTAT files. The CRSP monthly files are used to obtain per share stock prices three months after the end of the fiscal year. These prices should reflect the information included in the financial statements, since they must be published within three months of fiscal year end. The market value of a firm's common equity, P , is calculated as the per share price, adjusted for stock splits and dividends, times the number of common shares outstanding at fiscal year end. Bottom-line earnings adjusted for the effects of minority interest and preferred dividends are used. The one-year T-Bill rate is used as an estimate of the risk-free interest rate r , in the calculation of abnormal earnings.

The variable $V_i \tau_i$ raises some measurement issues. First, an estimate of the firm-specific tax rate is needed. In this study, the effective tax rate is used because it estimates the amount firms actually pay in taxes relative to their income in a given year, which is consistent with the definition of after-tax earnings specified in equation (3).¹⁰ The calculation of the firm's effective tax rate depends on the calculation of income, taxes, and taxable income (see Omer et al. 1991).¹¹

In this study, the effective tax rate τ_i is calculated using COMPUSTAT data as follows:¹²

$$\tau_i = \frac{\text{total tax expense} - \text{deferred tax expense}}{\text{pretax book income} - \frac{\text{deferred tax expense}}{\text{statutory marginal tax rate}}}$$

Second, the R&D tax shield calculation is based on the R&D tax expense from 1975 to 1980. From 1981 to 1985 the calculation is based on both the R&D tax expense and the R&D tax credit.¹³ The yearly samples consist of all firms with data on the variables required for this study, with a maximum R&D lag length of five years.

⁸ They are used in this study for two reasons: long lags of R&D expenditures can be obtained for a thorough analysis of lagged R&D on profits, and the net capital stock variable can be constructed with inflation-adjusted data. Since the earnings and advertising variables are measured in current dollars, the net capital stock and lagged R&D variables must be adjusted for inflation.

⁹ The definition of large mergers used by COMPUSTAT is employed. That is, when the effect of a merger on prior years' sales is 50 percent or more of the reported sales for that year, then the merger is large.

¹⁰ Arguments can also be made for the appropriateness of the marginal tax rate because R&D spending is an investment decision and investors may use the marginal tax rate in valuing R&D tax benefits. Marginal tax rates are more difficult to estimate than effective tax rates (see Shevlin 1990).

¹¹ Omer et al. (1991) examine five alternative measures of the effective tax rate using COMPUSTAT data. They suggest that the use of deferred tax expense is preferable to deferred tax liability.

¹² Following Omer et al. (1991), when both the numerator and the denominator were negative or zero, the firm was dropped from the sample. When the numerator was positive and the denominator was negative or zero, the tax rate was set to one.

¹³ The calculation of the effective tax rate for the period 1981 to 1985 takes into account the effects of the tax credit enacted by the Economic Recovery Tax Act (ERTA) of 1981. From 1981 to 1985 the credit applied to 25 percent of

Econometric Issues

The main objective in the estimation of the distributed lags, both in the earnings and valuation equations, is to derive efficient estimates of the direct effect of R&D expenditures on price

$$\sum_{\ell=0}^n \beta_{3,\ell}$$

and of the total effect of R&D expenditures on earnings

$$\sum_{\ell} \alpha_{3,\ell}.$$

The problem, in this case, is the high autocorrelation of consecutive R&D variables. Two estimation methods for distributed lag models are used in this study for consistency checks: the polynomial lag of Almon (1965) and the form-free lag technique of Hatanaka and Wallace (1980). The results obtained from the Almon lag method are reported here. The method and results of the form-free lag technique are discussed in the Appendix.

The Almon lag method assumes that the lagged coefficients of, for example, the valuation model $\beta_{3,\ell}$, follow a polynomial in ℓ . Thus, for a polynomial of degree two

$$\beta_{3,\ell} = c_0 + c_1\ell + c_2\ell^2 \quad (6)$$

the lagged part of equation (4) becomes

$$\begin{aligned} \sum_{\ell=0}^n \beta_{3,\ell} V_{t-\ell} &= \sum_{\ell=0}^n (c_0 + c_1\ell + c_2\ell^2) V_{t-\ell} \\ &= c_0 W_{0t} + c_1 W_{1t} + c_2 W_{2t}, \\ \text{where } W_{0t} &= \sum_{\ell=0}^n V_{t-\ell}, \quad W_{1t} = \sum_{\ell=0}^n \ell V_{t-\ell}, \quad W_{2t} = \sum_{\ell=0}^n \ell^2 V_{t-\ell}. \end{aligned}$$

This transformation reduces the number of lagged R&D variables from n to three (W_{0t}, W_{1t}, W_{2t}) without losing information. Thus, three R&D coefficients are estimated: c_0 , c_1 , and c_2 . These estimates are then used in equation (6) to derive the $\beta_{3,\ell}$ s. In addition, equation (6) allows the derivation of the variance-covariance matrix of $\beta_{3,\ell}$ s from the variance-covariance matrix of the c s.¹⁴

The assumption of homoscedasticity was rejected in all model specifications using the Goldfeld and Quandt test (see Johnston 1984, 300-301). As in prior studies, this issue is dealt

the excess (if any) of the taxpayer's R&D expenditures for the tax year over and above the average amount of R&D expenditures in the preceding three taxable years. The ERTA of 1986 reduced this to 20 percent.

¹⁴ An advantage of the Almon method over other distributed lag methods is that it allows various shapes of the lag distribution of $\beta_{3,\ell}$ s, depending on the polynomial fitted. Thus, a polynomial of degree one results in a monotonically increasing or decreasing distribution of $\beta_{3,\ell}$ s, and a polynomial of degree two results in an increasing then decreasing (decreasing then increasing) distribution of $\beta_{3,\ell}$ s. In contrast, the Koyck lag method imposes a declining pattern in the lag coefficients while the binomial lag imposes a quadratic pattern. The choice of the degree of the polynomial is based on the significance of successive c s. The choice of the lag length n is based on the maximum adjusted R^2 s and minimum standard errors.

with by scaling all variables: the earnings equation by net capital stock and the valuation equation by the book value of equity.¹⁵ However, residual analysis revealed significant departures from normality in the valuation equation even when the variables were scaled. Prior studies, such as Griliches (1981) and Cockburn and Griliches (1988), use the natural log of the market-to-book ratio as the dependent variable. Indeed, when the valuation equation was estimated in the semi-log form, the hypothesis of residual normality could not be rejected, and the residual variance and skewness were significantly reduced.¹⁶ This resulted in smaller standard errors, higher t-statistics, and higher regression R^2 s.

Thus, the empirical equations to be estimated are:

$$\frac{AX_{it}}{NC_{it}} = \alpha_0 \frac{1}{NC_{it}} + \alpha_1 \frac{NC_{it}}{NC_{it}} + \alpha_2 \frac{M_{it}}{NC_{it}} + \sum_{\ell=1}^n \alpha_{3,\ell} \frac{V_{it-\ell}}{NC_{it}} + e_{it} \quad (7)$$

and

$$\ln\left(\frac{P_{it}}{Y_{it}}\right) = a \frac{1}{Y_{it}} + \beta_0 \frac{Y_{it}}{Y_{it}} + \beta_1 \frac{X_{it}^B(1-\tau_{it}) - rY_{it-1}}{Y_{it}} + \beta_2 \frac{V_{it}\tau_{it}}{Y_{it}} + \sum_{\ell=0}^n \beta_{3,\ell} \frac{V_{it-\ell}}{Y_{it}} + u_{it}. \quad (8)$$

This is a recursive system of two equations in which the earnings and market value variables are endogenous, while the capital stock, advertising, R&D, and book value variables are exogenous. It assumes a causal link between R&D and earnings (equation 7) and then between earnings and market values (equation 8). For such a system equation-by-equation, ordinary least squares estimation is appropriate (see Johnston 1984, 467-69).

The regression parameters in equation (7) are expected to be positive.¹⁷ The parameter "a" in equation (8) is the intercept of the nonscaled model and should capture the valuation effects of variables not included in the equation, which may be positive, negative, or zero.¹⁸ In addition, if the theory is correct and the variables are measured without error, β_0 should not be different from zero (log of one), β_1 and β_2 should be positive, and

$$\sum_{\ell=0}^n \beta_{3,\ell}$$

can be positive, negative, or zero.

¹⁵ The problem of spurious correlation due to the common denominator raised by Lev and Sunder (1979) is not an issue in this case because the denominator is one of the variables in the model (see Maddala 1977, 265-68).

¹⁶ A χ^2 statistic was used to test for normality. When the market-to-book ratio was used as the dependent variable, the χ^2 statistic obtained values ranging from 194 to 458 with 23 degrees of freedom. When the log market-to-book was the dependent variable, the χ^2 statistic obtained values ranging from 21.7 to 37.5.

¹⁷ Note that the R&D lag structure in equation (7) does not allow for a contemporaneous effect of R&D on earnings. This is done for two reasons. First, it is unlikely that a firm can initiate, complete, and derive benefits from an R&D project all within one year. Second, and more important, it eliminates the possibility of double counting the effects of current R&D, V_{it} , on the market value of equity given its presence in the lag structure of the valuation model equation (8) and its value relevance detected in prior studies.

¹⁸ In a weighted least squares, the intercept should also be deflated (see Johnston 1984, 302).

IV. Empirical Results

Descriptive Statistics

Table 1 presents some descriptive statistics of the regression variables used in the estimation of the earnings and valuation equations (7) and (8) for 1978. The independent variables in both equations are truncated at ± 3 standard deviations from the variable's means. The truncation was necessary to eliminate outliers and thus to derive sensible results.¹⁹

Panels A and B present some distributional statistics for the regression variables used in the earnings and valuation equations, respectively. The correlation matrix in Panel A reveals persistently high correlation between the lagged R&D and the earnings variables. This contrasts with the smaller and rapidly declining correlations between the lagged R&D and market-to-book variables revealed in the correlation matrix in Panel B. Both correlation matrices indicate high correlation among the lagged R&D variables. In addition, the matrix in Panel B indicates high correlation between the earnings and market-to-book variables, and between the tax shield and R&D expenditures variables. Also, in Panel B, the correlation coefficients of the tax shield and the current R&D variables with the market-to-book variable are very close (0.285 and 0.317).

Valid data for price, earnings, book values, and current R&D expenditures were available for 758 firms for 1978. From this sample, 591 firms had valid data for lagged R&D expenditures and for effective tax rate calculations. Removing outliers eliminated 18 more firms, leaving a sample of 573 for analysis.

The Earnings Equation

Table 2 presents the results from the estimation of the earnings model from 1975 to 1985. The dependent variable is earnings before extraordinary items and before advertising and R&D expenditures.²⁰ The results indicate a strong relationship between earnings, capital stock, advertising, and R&D expenditures. The adjusted R^2 s range from 35 percent in 1979 to 88 percent in 1977, with a mean value of 63 percent. The capital stock and advertising coefficients are always positive and highly significant. The polynomials fitted to estimate the lagged R&D coefficients were all of degree 2 or 3: in all 11 years lagged R&D effects are detected. The mean lags range from 2.3 to 4.1 years, with an overall mean of 3.4 years, indicating that R&D benefits last, on average, for approximately seven years (2 times 3.4 years). The lagged R&D coefficients are positive and highly significant. Increments in R^2 s due to R&D are, in some cases, close to 50 percent of the reported R^2 values. The interpretation of the lag structure in 1976, for example, is as follows: suppose that the average sample firm appropriately invested one dollar in R&D over the period 1972-1975. Then, in 1976, the firm realized benefits of \$0.29 from the 1972 investment, \$0.65 from the 1973 investment, \$0.81 from the 1974 investment, and \$0.63 from the 1975 investment, which sum to the total benefit of \$2.38. The total effect on earnings of R&D in prior years

$$\sum_{\ell=1}^n \alpha_{3,\ell},$$

¹⁹ Estimation of the models based on untruncated data yielded regression coefficients that were far from theoretically expected values. For example, in many of the yearly regressions earnings and tax shield coefficients were significantly negative.

²⁰ The results from the bottom line earnings were weak in most cases. It is possible that extraordinary items and the adjustments required introduced noise in the numbers.

Table 1

Panel A: Descriptive Statistics of Regression Variables of the Earnings Model in 1978

<i>Distributional Statistics</i>					
<i>Variable</i>	<i>Mean</i>	<i>Median</i>	<i>Standard Deviation</i>	<i>Min</i>	<i>Max</i>
$\frac{AX_{it}}{NC_{it}}$	0.201	0.184	0.153	-0.061	1.356
$\frac{1}{NC_{it}}$	0.032	0.003	0.082	0.0001	0.651
$\frac{M_{it}}{NC_{it}}$	0.036	0.019	0.056	0.000	0.290
$\frac{V_{it-1}}{NC_{it}}$	0.063	0.044	0.107	0.000	1.113
$\frac{V_{it-2}}{NC_{it}}$	0.056	0.041	0.071	0.000	0.671
$\frac{V_{it-3}}{NC_{it}}$	0.055	0.040	0.080	0.000	0.804
$\frac{V_{it-4}}{NC_{it}}$	0.059	0.042	0.102	0.000	1.078
$\frac{V_{it-5}}{NC_{it}}$	0.068	0.042	0.199	0.000	2.166

<i>Product Moment Correlation Matrix</i>							
	$\frac{AX_{it}}{NC_{it}}$	$\frac{1}{NC_{it}}$	$\frac{M_{it}}{NC_{it}}$	$\frac{V_{it-1}}{NC_{it}}$	$\frac{V_{it-2}}{NC_{it}}$	$\frac{V_{it-3}}{NC_{it}}$	$\frac{V_{it-4}}{NC_{it}}$
$\frac{1}{NC_{it}}$	0.509						
$\frac{M_{it}}{NC_{it}}$	0.401	-0.029					
$\frac{V_{it-1}}{NC_{it}}$	0.797	0.684	0.001				
$\frac{V_{it-2}}{NC_{it}}$	0.771	0.628	0.030	0.969			
$\frac{V_{it-3}}{NC_{it}}$	0.771	0.689	0.014	0.974	0.974		
$\frac{V_{it-4}}{NC_{it}}$	0.768	0.743	-0.012	0.969	0.934	0.976	
$\frac{V_{it-5}}{NC_{it}}$	0.740	0.746	-0.017	0.949	0.877	0.936	0.976

Note: The sample size is 118 firms. The variables are truncated between ± 3 standard deviations from the mean. AX_{it} = earnings before extraordinary items and before advertising and R&D expenditures of firm i at time t ; NC_{it} = net capital stock of firm i at time t , measured as the sum of the inflation-adjusted net book value of property, plant, and equipment, the inflation-adjusted value of inventories, and the inflation-adjusted value of recorded intangibles; M_{it} = advertising expenditures of firm i at time t ; and $V_{it-\ell}$ = R&D expenditures of firm i at time $t - \ell$.

Table 1 (Continued)
Panel B: Descriptive Statistics of Regression Variables of the Valuation Model in 1978

Distributional Statistics					
Variable	Mean	Median	Standard Deviation	Min	Max
$\frac{P_{it}}{Y_{it}}$	1.284	1.064	0.774	-0.858	5.595
$\frac{1}{Y_{it}}$	0.024	0.021	0.035	-0.028	0.220
$\frac{X_{it}^B(1-\tau_{it})-rY_{it-1}}{Y_{it}}$	0.106	0.104	0.089	-0.341	0.408
$\frac{Y_{it}\tau_{it}}{Y_{it}}$	0.023	0.017	0.022	-0.008	0.200
$\frac{V_{it}}{Y_{it}}$	0.054	0.040	0.049	-0.005	0.307
$\frac{V_{it-1}}{Y_{it}}$	0.046	0.036	0.040	-0.005	0.258
$\frac{V_{it-2}}{Y_{it}}$	0.042	0.033	0.036	-0.012	0.251
$\frac{V_{it-3}}{Y_{it}}$	0.040	0.030	0.032	-0.011	0.226
$\frac{V_{it-4}}{Y_{it}}$	0.036	0.028	0.030	-0.009	0.200
$\frac{V_{it-5}}{Y_{it}}$	0.033	0.026	0.030	0.000	0.230

Continued

Table 1 (Continued)
 Panel B: Descriptive Statistics of Regression Variables of the Valuation Model in 1978 (Continued)

Product Moment Correlation Matrix									
	$\frac{P_t}{Y_t}$	$\frac{1}{Y_t}$	$\frac{X_t^B(1-\tau_t)-rY_t}{Y_t}$	$\frac{V_t\tau_t}{Y_t}$	$\frac{V_t}{Y_t}$	$\frac{V_{t-1}}{Y_t}$	$\frac{V_{t-2}}{Y_t}$	$\frac{V_{t-3}}{Y_t}$	$\frac{V_{t-4}}{Y_t}$
$\frac{1}{Y_t}$	-0.048								
$\frac{X_t^B(1-\tau_t)-rY_{t-1}}{Y_t}$	0.585	0.014							
$\frac{V_t\tau_t}{Y_t}$	0.285	-0.029	0.345						
$\frac{V_t}{Y_t}$	0.317	0.045	0.490	0.863					
$\frac{V_{t-1}}{Y_t}$	0.269	0.048	0.446	0.830	0.969				
$\frac{V_{t-2}}{Y_t}$	0.221	0.087	0.412	0.771	0.902	0.951			
$\frac{V_{t-3}}{Y_t}$	0.199	0.058	0.382	0.738	0.853	0.900	0.943		
$\frac{V_{t-4}}{Y_t}$	0.149	0.045	0.336	0.716	0.809	0.856	0.896	0.945	
$\frac{V_{t-5}}{Y_t}$	0.116	0.072	0.343	0.630	0.731	0.783	0.853	0.864	0.909

Note: The sample size is 573 firms. The variables are truncated between ± 3 standard deviations from the mean. P_t = market value of equity of firm i at time t ; Y_t = book value of equity of firm i at time t ; X_t^B = earnings after extraordinary items less preferred dividends and before expensing R&D expenditures of firm i at time t ; V_{t-j} = R&D expenditures of firm i at time $t-j$; τ_t = effective tax rate of firm i at time t ; and r = the one year T-Bill rate obtained from the Annual Statistical Digest, Federal Reserve System.

Table 2
Cross-Sectional Regression Results of Earnings, Adjusted for the Expensing of Advertising and R&D Expenditures, on Net Capital Stock, Advertising, and Lagged R&D Expenditures, All Deflated by Net Capital Stock

$$\text{Model: } \frac{AX_{it}}{NC_{it}} = \alpha_0 \frac{1}{NC_{it}} + \alpha_1 \frac{NC_{it}}{NC_{it}} + \alpha_2 \frac{M_{it}}{NC_{it}} + \sum_{\ell=1}^n \alpha_{3,\ell} \frac{V_{it-\ell}}{NC_{it}} + e_{it}$$

Year	Number of Firms	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\alpha}_{3,1}$	$\hat{\alpha}_{3,2}$	$\hat{\alpha}_{3,3}$	$\hat{\alpha}_{3,4}$	$\hat{\alpha}_{3,5}$	$\hat{\alpha}_{3,6}$	$\hat{\alpha}_{3,7}$	Adjusted R^2	$\sum_{\ell=1}^n \hat{\alpha}_{3,\ell}$	Mean Lag	Degree of Polynomial
1975	66	0.009 (0.039)	0.051 (3.583)	1.239 (7.848)	0.199 (7.960)	0.339 (8.071)	0.419 (8.058)	0.440 (8.000)	0.401 (7.863)	0.302 (7.550)	0.144 (5.143)	0.70	2.244	3.9	2
1976	75	0.365 (1.435)	0.098 (7.722)	1.245 (8.129)	0.635 (6.755)	0.808 (6.906)	0.649 (7.211)	0.288 (7.024)				0.64	2.380	2.3	3
1977	95	-0.219 (-1.585)	0.079 (8.032)	1.087 (9.822)	0.345 (6.273)	0.471 (6.117)	0.435 (6.692)	0.293 (8.371)	0.103 (9.404)	0.078 (2.000)		0.88	1.725	2.8	3
1978	118	0.006 (0.004)	0.093 (9.398)	1.109 (9.053)	0.233 (5.178)	0.346 (5.406)	0.365 (5.794)	0.312 (6.638)	0.212 (8.833)	0.091 (8.273)		0.77	1.559	3.1	3
1979	149	-0.139 (-1.885)	0.097 (6.233)	1.025 (7.394)	0.155 (4.697)	0.265 (4.818)	0.330 (4.925)	0.349 (5.058)	0.324 (5.226)	0.254 (5.292)	0.139 (3.564)	0.35	1.816	3.9	2
1980	204	0.131 (1.590)	0.070 (11.229)	1.084 (15.996)	0.181 (9.050)	0.311 (9.424)	0.391 (9.775)	0.422 (10.048)	0.402 (10.865)	0.332 (11.857)	0.212 (10.600)	0.72	2.251	4.0	2
1981	310	0.047 (0.371)	0.077 (11.297)	1.097 (15.786)	0.132 (6.238)	0.228 (6.333)	0.287 (6.674)	0.311 (7.068)	0.299 (7.667)	0.250 (8.621)	0.165 (6.875)	0.57	1.672	4.1	2
1982	326	0.338 (3.404)	0.051 (7.371)	1.267 (24.929)	0.527 (8.234)	0.695 (8.797)	0.601 (10.186)	0.342 (12.214)				0.73	2.165	2.4	3

(Continued)

Table 2 (Continued)

Year	Number of Firms	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\alpha}_{3,1}$	$\hat{\alpha}_{3,2}$	$\hat{\alpha}_{3,3}$	$\hat{\alpha}_{3,4}$	$\hat{\alpha}_{3,5}$	$\hat{\alpha}_{3,6}$	$\hat{\alpha}_{3,7}$	Adjusted R^2	$\sum_{t=1}^7 \hat{\alpha}_{3,t}$	Mean Lag	Degree of Polynomial
1983	322	0.295 (2.654)	0.072 (7.784)	1.305 (17.476)	0.378 (8.400)	0.536 (8.645)	0.522 (8.847)	0.384 (8.930)	0.171 (6.107)			0.55	1.991	2.7	3
1984	337	0.138 (0.768)	0.103 (9.538)	1.040 (12.394)	0.128 (2.030)	0.088 (1.984)	0.454 (5.470)	0.777 (7.330)	0.863 (6.035)	0.519 (3.611)		0.39	2.829	4.3	3
1985	311	0.411 (2.425)	0.055 (6.531)	1.279 (20.723)	0.236 (9.833)	0.396 (10.154)	0.479 (10.413)	0.485 (10.778)	0.415 (11.528)	0.268 (11.167)		0.68	2.279	3.5	2
Mean		0.126 (1.999)	0.077 (13.441)	1.162 (36.704)	0.286 (5.646)	0.408 (6.475)	0.449 (13.508)	0.400 (9.476)	0.290 (3.942)	0.190 (3.729)	0.060 (2.341)	0.63	2.083	3.4	
T-Ratio															

Note: Numbers in parentheses under the estimated parameters are t statistics. The T-Ratios in the final row are calculated as the mean coefficient over the 11 years divided by the standard error of the mean. AX_{it} = earnings before extraordinary items and before advertising and R&D expenditures of firm i at time t ; NC_{it} = net capital stock of firm i at time t , measured as the sum of the inflation-adjusted net book value of property, plant, and equipment, the inflation-adjusted book value of inventories, and the inflation-adjusted book value of recorded intangibles; M_{it} = advertising expenditures of firm i at time t ; and V_{it} = R&D expenditures of firm i at time $t - \ell$. The R&D lag structure is estimated using the Almon polynomial method. The mean lag is defined as

$$\frac{\sum_{t=1}^7 \ell \hat{\alpha}_{3,t}}{\sum_{t=1}^7 \hat{\alpha}_{3,t}}.$$

ranges from 1.559 in 1978 to 2.829 in 1984 with a mean value of 2.083.²¹ This implies that a one-dollar outlay in R&D leads to a two-dollar increase in earnings of the sample firms over a seven-year period.²² This translates into an average return on investment of 26 percent (the discount rate that sets the present value of the mean lag coefficients equal to one in year zero). Recall that this is a gross return given the absence of R&D cost in the estimated earnings model.²³

The Valuation Equation

Table 3 presents the results from the estimation of the valuation model from 1975 to 1985. As predicted, $\hat{a}$ takes positive, negative, and zero values, reflecting mean valuation effects of omitted variables. The book value parameter $\hat{\beta}_0$ is equal to zero only in 1980. The deviation of $\hat{\beta}_0$ from its theoretical value of zero may be due to a bias induced by the correlation between the book value of equity and one or more omitted variables. However, its mean value of -0.055 is not significantly different from zero.

The earnings valuation parameter, $\hat{\beta}_1$, is positive and highly significant in each yearly regression. In all 11 years, the value of $\hat{\beta}_1$ is greater than one, indicating that the market capitalizes earnings in determining the market values of the sample firms. Note that the earnings parameters for the period 1975-1980 are higher, on average, than those for the period 1981-1985. This implies that investors saw the earnings of the latter period as less permanent than the earnings of the earlier period. The mean value of $\hat{\beta}_1$ is 2.757, indicating that, on average, a one-dollar increase in earnings leads to an increase in the market value of sample firms of slightly less than three dollars.

The R&D tax shields valuation parameter $\hat{\beta}_2$ is always positive. It is significant at the 5 percent level in ten out of eleven years and at the 10 percent level in 1977. Its values range from 1.240 in 1984 to 5.391 in 1975. While one could expect the value of $\hat{\beta}_2$ not to be significantly different from one (one dollar of taxes saved equals a one-dollar increase in market value), this is clearly not true in the case of R&D tax shields. The parameter $\hat{\beta}_2$ is statistically greater than

²¹ To be strictly correct, the estimated effect of R&D expenditure in year t should be the sum of the lag 1 coefficient from year $t+1$, the lag 2 coefficient from year $t+2$, etc. However, there are two disadvantages to this approach. One, since we need seven lags to complete the estimate for one year and have data for only 11 years, we would be left with only four yearly estimates. Two, we assume that investors valuing R&D in year t consider the lag ℓ coefficient from year t to be the estimate that best reflects the most recent economic and market information.

²² Three additional measures of profitability were used as dependent variables in the profitability model: pretax earnings, operating income, and gross margin (sales less cost of goods sold). Both pretax earnings and operating income were adjusted for the expensing of advertising and R&D. The results based on gross margin yielded the lowest R^2 s but the highest estimated total effect, whereas the results based on after-tax earnings and reported in table 2 yielded the highest R^2 s and the lowest estimated total effect. The use of per share and unscaled data did not materially change the results reported in table 2.

²³ The estimated lagged R&D coefficients in table 2 can be used to estimate R&D amortization rates if R&D expenditures were to be capitalized. For simplicity, the estimation here is based on the mean coefficients of each period. The amortization rate for each period, δ_ℓ , is calculated as the ratio of the mean coefficient at time $t - \ell$, $\ell = 1, \dots, 7$, to the sum of the mean coefficients. Thus, $\delta_1 = 0.286/2.083 = 0.137$, $\delta_2 = 0.408/2.083 = 0.196$, $\delta_3 = 0.449/2.083 = 0.216$, $\delta_4 = 0.400/2.083 = 0.192$, $\delta_5 = 0.290/2.083 = 0.139$, $\delta_6 = 0.190/2.083 = 0.091$, $\delta_7 = 0.060/2.083 = 0.029$, with

$$\sum_{\ell=1}^7 \delta_\ell = 1$$

These rates indicate what percentage of R&D investment should be amortized in a given period to match costs and benefits. For example, 13.7 percent should be amortized in the year following the investment, 19.6 percent in the year following, etc. This represents an improvement over methods that provide only one straight line amortization rate. It should be noted that the rates estimated here are accounting-based amortization rates. To know whether these rates differ from market implied (economic) rates requires further investigation.

one in every year except 1984. Moreover, in 10 of the 11 regressions, and on average, the difference between $\hat{\beta}_2$ and $\hat{\beta}_1$ is not significant (see the second to last column of table 3). This implies that R&D tax shields are valued like earnings.²⁴

The direct effect of R&D outlays on market value is measured by

$$\sum_{t=0}^n \hat{\beta}_{3,t},$$

and is estimated using the Almon polynomial lag method. The polynomials fitted were of degree one in 1983 and 1984, and zero in all other years. A polynomial of degree zero means that there is no lag pattern in the data and only the current R&D variable is value-relevant. The lag coefficients for 1983 and 1984 are given at the bottom of table 3. The main effect is captured by the current R&D variable, which is positive and highly significant in both these years. The mean lag in all years is zero, a result consistent with Griliches (1981).²⁵ The zero mean lag may be due to one or more of the following reasons: earnings sufficiency (earnings provide sufficient information about lagged R&D investments), market efficiency (no lagged variables can be used to predict stock prices), and the current R&D variable is sufficient for the lagged R&D variables.

The direct effect of R&D outlays on market value

$$\sum_{t=0}^n \hat{\beta}_{3,t}$$

ranges from -2.316 to 2.520 and is significant in six out of eleven years. In three years it is significantly negative. These negative values imply that the costs of R&D exceed the expected benefits in these years. Note that

$$\sum_{t=0}^n \hat{\beta}_{3,t}$$

is insignificant in five out of eleven years, implying that in those years the R&D information in earnings was sufficient to value current R&D. The mean value of -0.092 is also insignificant. Overall, the results suggest that R&D variables can be informative in the short-run, but in the long-run investors rely on the R&D information conveyed in earnings. Thus R&D variables are valued conditional on earnings.²⁶

²⁴ Multicollinearity tests using the regression coefficient variance decomposition method revealed low condition indices (between 5 and 12) but high variance-decomposition proportions. For example, in examining the smallest sample (1975), the condition index was 5.32 while the variance proportions were 0.82 and 0.96 for the tax shield and R&D variables, respectively. As Belsley (1991) points out, multicollinearity is an issue only when high condition indices and high variance proportions occur together. In addition, when the tax shield was not disaggregated from earnings, the R&D coefficient and its t-statistic increased only marginally. For example, in 1975 the coefficient was -1.346 with a t-statistic of -1.166 versus -1.895 with a t-statistic of -1.151 in table 3.

²⁵ The mean lag is defined as

$$\frac{\sum_{t=0}^n t \hat{\beta}_{3,t}}{\sum_{t=0}^n \hat{\beta}_{3,t}},$$

and it indicates the length of the period during which half the impact of a change in the market value will be felt.

²⁶ The following sensitivity tests were conducted to examine the robustness of the results from model (8): (a) an advertising variable was included with the appropriate adjustment of earnings, given the expensing of advertising; (b) the R&D tax shield was not disaggregated out of earnings; (c) earnings before extraordinary items was used in place of bottom-line earnings; and (d) per share and nonscaled data (using White's [1980] heteroscedastic-consistent covariance matrix estimation method) was used. The results from all these tests are very similar to those reported in table 3. Since the advertising parameter was not significant, the variable was omitted. This omission resulted in larger sample sizes because advertising data were frequently missing from the COMPUSTAT files.

Table 3

Cross-Sectional Regression Results of the Natural Log of Market to Book Ratio on Book Value of Equity, Abnormal Earnings Adjusted for the Expensing of R&D, R&D Tax Shields, and Current and Lagged R&D Expenditures, All Deflated by Current Book Value

$$\text{Model: } \ln\left(\frac{P_e}{Y_t}\right) = \alpha \frac{1}{Y_t} + \beta_0 \frac{Y_t}{Y_t} + \beta_1 \frac{[X_t^B(1-\tau_t) - rY_{t-1}]}{Y_t} + \beta_2 \frac{V_t \tau_t}{Y_t} + \sum_{i=0}^n \beta_{3,i} \frac{V_{t-i}}{Y_t} + u_t$$

Year	Number of Firms	$\hat{\alpha}$	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\sum_{i=0}^n \hat{\beta}_{3,i}$	Mean Lag	Adjusted R^2	Degree of Polynomial	$\hat{\beta}_2 - \hat{\beta}_1$	r
1975	347	-2.726 (-4.363)	-0.255 (-5.361)	4.971 (13.734)	5.391 (3.221)	-2.004 (-2.173)	0	0.40	0	0.420 (0.260)	6.28%
1976	528	-3.263 (-7.323)	-0.374 (-10.766)	5.101 (20.339)	2.595 (2.001)	-2.113 (-3.219)	0	0.47	0	-2.506 (-1.936)	5.52%
1977	588	-1.159 (-2.551)	-0.319 (-10.091)	3.310 (16.142)	2.181 (1.782)	-0.687 (-0.953)	0	0.37	0	-1.129 (-0.954)	5.71%
1978	573	-0.647 (-1.335)	-0.311 (-9.912)	4.031 (17.860)	5.499 (3.573)	-2.316 (-3.043)	0	0.42	0	1.468 (0.969)	7.774%
1979	548	0.599 (0.794)	-0.247 (-6.600)	2.251 (11.464)	4.941 (3.246)	-0.589 (-0.743)	0	0.26	0	2.690 (1.825)	9.75%
1980	522	2.983 (3.952)	0.014 (0.395)	2.259 (12.447)	2.798 (2.052)	0.377 (0.509)	0	0.31	0	0.539 (0.417)	10.89%
1981	518	2.162 (2.681)	-0.167 (-4.666)	2.637 (13.093)	3.614 (3.734)	-0.151 (-0.219)	0	0.28	0	0.977 (1.071)	13.14%
1982	469	1.904 (2.104)	0.152 (3.779)	1.883 (9.566)	2.329 (3.667)	1.313 (2.265)	0	0.24	0	0.446 (0.749)	11.07%

(Continued)

Table 3 (Continued)

Year	Number of Firms	$\hat{\alpha}$	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\sum_{t=0}^n \hat{\beta}_{3,t}$	Mean Lag	Adjusted R^2	Degree of Polynomial	$\hat{\beta}_2 - \hat{\beta}_1$	r
1983	475	0.809 (1.238)	0.242 (7.718)	1.149 (9.733)	3.953 (5.490)	2.002 (14.000)	0.33	0.27	1	2.804 (4.157)	8.80%
1984	478	1.725 (2.760)	0.251 (7.772)	1.307 (9.372)	1.240 (4.960)	2.520 (21.913)	0.36	0.26	1	-0.067 (-0.321)	9.92%
1985	455	0.059 (0.071)	0.406 (10.396)	1.426 (10.876)	1.986 (2.609)	0.634 (1.103)	0	0.25	0	0.560 (0.798)	7.81%
Mean		0.222	-0.055	2.757	3.321	-0.092		0.32		0.564	
T-Ratio		(0.366)	(-0.659)	(6.453)	(7.539)	(-0.185)				(1.227)	

Note: Numbers in parentheses under the estimated parameters are t statistics. The T-Ratios in the final row are calculated as the mean coefficient over the 11 years divided by the standard error of the mean. P_t = market value of equity of firm i at time t ; Y_{it} = book value of equity of firm i at time t ; X_{it}^B = earnings after extraordinary items less preferred dividends and before expensing R&D expenditures of firm i at time t ; $V_{it-\ell}$ = R&D expenditures of firm i at time $t - \ell$; t_{it} = effective tax rate of firm i at time t ; and r = the one year T-Bill rate obtained from the Annual Statistical Digest, Federal Reserve System. The R&D lag structure is estimated using the Almon polynomial method. The mean lag is defined as

$$\sum_{t=0}^n \ell \hat{\beta}_{3,t} / \sum_{t=0}^n \hat{\beta}_{3,t}$$

The estimated lagged coefficients and t statistics for 1983 and 1984 are:

	$\hat{\beta}_{3,0}$	$\hat{\beta}_{3,1}$	$\hat{\beta}_{3,2}$	$\hat{\beta}_{3,3}$	$\hat{\beta}_{3,4}$	$\hat{\beta}_{3,5}$
1983	1.333 (3.632)	0.669 (2.884)	0.004 (0.034)	-0.660 (-0.123)	-1.025 (-1.239)	-1.245 (-1.374)
1984	1.617 (5.880)	0.903 (5.440)	0.189 (1.562)	-0.526 (-1.104)	-1.239 (-1.205)	-1.594 (-1.317)

The significant coefficients are included in the calculation of $\sum_{t=0}^n \hat{\beta}_{3,t}$.

The Investment Value of R&D

One objective of this study is to estimate the after-tax investment value of R&D. Equation (5)

$$\frac{dP_t}{dV} = \beta_1 \frac{d[X_t^B(1-\tau_t)]}{dV} + \sum_{\ell=0}^n \beta_{3,\ell} \quad (5)$$

shows that the investment value of R&D, $\frac{dP_t}{dV}$, consists of an indirect effect of R&D on price through earnings,

$$\beta_1 \frac{d[X_t^B(1-\tau_t)]}{dV},$$

and a direct effect of R&D on price,

$$\sum_{\ell=0}^n \beta_{3,\ell},$$

The estimation of these effects is shown in table 4. Estimates of the indirect effect are given by the product

$$\hat{\beta}_1 \sum_{\ell=0}^n \hat{\alpha}_{3,\ell},$$

where $\hat{\beta}_1$ is the estimate of the earnings valuation parameter β_1 , and $\sum_{\ell=1}^n \hat{\alpha}_{3,\ell}$ is the estimate of the total effect of R&D on earnings,

$$\frac{d[X_t^B(1-\tau_t)]}{dV}.$$

Estimates of the direct effect,

$$\sum_{\ell=0}^n \beta_{3,\ell},$$

are given by

$$\sum_{\ell=0}^n \hat{\beta}_{3,\ell}.$$

Estimates of the total effect, $\frac{dP_t}{dV}$, are given by the sum $\hat{\beta}_1 \sum_{\ell=1}^n \hat{\alpha}_{3,\ell} + \sum_{\ell=0}^n \hat{\beta}_{3,\ell}$.

On average, and in all years, the indirect effect is much greater than the direct effect. This implies that earnings numbers consistently convey much more information about the firm's R&D than do the R&D numbers themselves. Estimates of the total effect range from 3.499 in 1979 to 10.027 in 1976, with a mean value of 5.561. This is the present value of the expected benefits from a one-dollar increase in R&D appropriately invested over the average sample firm's investment horizon. Clearly, the market rewards to R&D are substantial.²⁷

²⁷ One can argue that the estimated investment value of R&D is rather high, especially in 1975 and 1976. R&D might well be a proxy for other nonquantifiable components of intangible capital such as the overall know-how of the firm, management skills, or risk taking attitudes, thus inflating the estimated values (see Cohen and Levin 1989).

Table 4
Estimation of the Investment Value of R&D 1975-1985

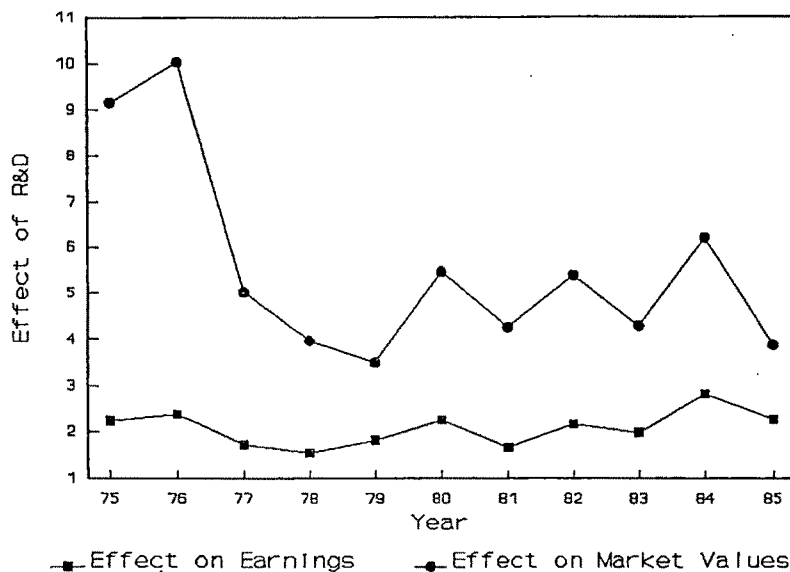
		Effect of R&D Investment on:			
		Market Price			
		Earnings	Indirect	Direct	Total
Year	$\hat{\beta}_1$	$\sum_{\ell=1}^n \hat{\alpha}_{3,\ell}$	$\hat{\beta} \sum_{\ell=1}^n \hat{\alpha}_{3,\ell}$	$\sum_{\ell=0}^n \hat{\beta}_{3,\ell}$	$\hat{\beta} \sum_{\ell=1}^n \hat{\alpha}_{3,\ell} + \sum_{\ell=0}^n \hat{\beta}_{3,\ell}$
1975	4.971	2.244	11.155	-2.004	9.151
1976	5.101	2.380	12.140	-2.113	10.027
1977	3.310	1.725	5.710	-0.687	5.023
1978	4.031	1.559	6.284	-2.316	3.968
1979	2.251	1.816	4.088	-0.589	3.499
1980	2.259	2.251	5.085	0.377	5.462
1981	2.637	1.672	4.409	-0.151	4.258
1982	1.883	2.165	4.077	1.313	5.390
1983	1.149	1.991	2.288	2.002	4.290
1984	1.307	2.829	3.698	2.520	6.218
1985	1.426	2.279	3.250	0.634	3.884
Mean	2.757	2.083	5.653	-0.092	5.561

Note: The estimated investment value of R&D is the total effect of R&D investment on market price given in the last column of this table. The calculation of this effect is based on equation (5).

$$\frac{dP_t}{dV} = \beta_1 \frac{d[X_t^B(1-\tau_t)]}{dV} + \sum_{\ell=0}^n \frac{\partial P_t}{\partial V_{t-\ell}} = \hat{\beta}_1 \sum_{\ell=1}^n \hat{\alpha}_{3,\ell} + \sum_{\ell=0}^n \hat{\beta}_{3,\ell}$$

An estimate of the earnings valuation parameter β_1 is $\hat{\beta}_1$ in table 3. An estimate of the total effect of R&D on earnings $\frac{d[X_t^B(1-\tau_t)]}{dV}$ is $\sum_{\ell=1}^n \hat{\alpha}_{3,\ell}$ in table 2, and an estimate of the direct effect of R&D on market price $\sum_{\ell=0}^n \frac{\partial P_t}{\partial V_{t-\ell}}$ is $\sum_{\ell=0}^n \hat{\beta}_{3,\ell}$ in table 3. While the indirect effect captures only R&D benefits, the direct effect captures both costs and benefits. Thus, the negative values of the direct effect imply the excess of costs over benefits in some cases.

Figure 1
The Effects of R&D Investment on Earnings and Market Value



Note: The effects of R&D investment on earnings and market value are taken from table 4.

Figure 1 represents the patterns of estimated total effects of R&D on earnings and market value for the period 1975-1985. Note the strong similarity in the two patterns. Clearly, the market value effects closely follow those of earnings, indicating the importance of R&D information conveyed by earnings.²⁸

V. Summary

This study seeks to determine the productivity of corporate R&D by examining its long-run impact on accounting earnings and the market value of equity. The research focuses on how to extract realized R&D benefits from reported earnings and how to use those benefits in determining the investment value of R&D.

Cross-sectional data is used to estimate two models for a sample of large U.S. corporations engaged in R&D: an earnings model that determines the impact of R&D investment on earnings and a valuation model that determines the impact of R&D investment on market values.

The study finds that, on average, a one-dollar increase in R&D leads to a two-dollar increase in profit over a seven-year period and a five-dollar increase in market value. The long-run

²⁸ When the market-to-book ratio (without the natural log) was used as the dependent variable in the valuation model, the corresponding mean values of table 4 were 4.042 for the earnings parameter $\hat{\beta}_1$; 8.419 for the indirect effect; 0.664 for the direct effect; and 9.083 for the total effect.

impact of R&D on market value consists of two effects: one indirect and one direct. The indirect effect is the capitalized value of realized R&D benefits reflected in earnings and expected to persist in the future. The direct effect relates to new R&D information conveyed directly by R&D variables. On average, the indirect effect is much greater than the direct, indicating the importance of earnings and implying that R&D variables are valued conditional on earnings. Finally, R&D tax shields are found to be valued as earnings.

A limitation of this study is the use of samples across industries in estimating the valuation and earnings models. The industry-by-industry estimation of the earnings model, for example, should allow the estimation of industry-specific R&D amortization rates that can be used to investigate the R&D accounting issue along the lines suggested by Lev (1989) or by the FASB, were it to adopt a policy of R&D capitalization. Further, the separation of benefits, realized or expected, from product and process R&D can assist in determining which type of R&D is more productive. At present, such a separation is impossible given the absence of disclosure requirements for these two types of R&D spending.

Appendix

The Form-Free Lag Technique

It is important to test the sensitivity of the results derived using the Almon polynomial in both the valuation and earnings models. A disadvantage of the Almon method is that it imposes specific constraints on the lag distribution (linear, quadratic, cubic, etc.) which can bias the estimated coefficients. The only method available in the literature that imposes no constraints is the form-free lag technique of Hatanaka and Wallace (1980). However, this technique also has its limitation: it allows estimation not of the lag coefficients but of the moments of the lag distribution. The transformation suggested by Hatanaka and Wallace, for example, for the distributed lag of the valuation model equation (8), is:

$$\begin{bmatrix} \mu_0 \\ \mu_1 \\ . \\ . \\ . \\ \mu_n \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & \dots & 1 \\ 0 & 1 & 2 & \dots & n \\ . & . & . & \dots & . \\ . & . & . & \dots & . \\ . & . & . & \dots & . \\ 0 & 1 & 2^n & \dots & n^n \end{bmatrix} \begin{bmatrix} \beta_{3,0} \\ \beta_{3,1} \\ . \\ . \\ . \\ \beta_{3,n} \end{bmatrix} \quad (\text{A.1})$$

where μ_0 is the estimate of

$$\sum_{\ell=0}^n \beta_{3,\ell};$$

μ_1 is the mean; μ_2 is the variance; and μ_3 through μ_n are the higher-order moments of the lag distribution of $\beta_{3,\ell}$ s. Hatanaka and Wallace show that, in the transformation, the presence of high correlation in the lagged variables can be used to advantage to obtain estimates of the lower-order moments. That is, the moments have less variance than estimates of other linear combinations of the $\beta_{3,\ell}$ s, with precision ordered from lower to higher moments. The ratio μ_1/μ_0 is an estimate of the mean lag of the distribution. Since this study focuses on the estimation of the sum of the lag coefficients

$$\sum_{\ell=0}^n \beta_{3,\ell} \text{ and } \sum_{\ell=1}^n \alpha_{3,\ell}$$

and on the mean lags, the form-free technique can be used to examine the sensitivity of the corresponding results obtained using the Almon lag technique.

The results from the form-free lag technique for the valuation model are similar to those reported in table 3. The technique detected no lag effects in any of the 11 years examined, the mean value of $\hat{\beta}_1$ is 3.094 versus 2.757 in table 3, and the mean value of

$$\sum_{t=0}^n \beta_{3,t}$$

is -0.975, versus -0.092 in table 3.

The results from the form-free lag technique for the earnings model are also similar to those reported in table 2, although truncation beyond ± 3 standard deviations was required in some cases. The estimated total effect of R&D on earnings

$$\sum_{t=1}^n \hat{\alpha}_{3,t}$$

is highly significant in every year and has a mean value of 2.291 versus 2.083 in table 2. Thus the mean estimated total effect of R&D on market price is 6.113 ($3.094 \times 2.291 - 0.975$) versus 5.561 in table 4. The technique detected lag effects in all years, although in 1975, 1976, and 1977 the lag effects are rather weak (one to two years). This may be due to smaller sample sizes in those years. Nonetheless, the overall mean lag is 3.2 years versus 3.4 years in table 2.

References

- Abdel-khalik, A. R. 1975. Advertising effectiveness and accounting policy. *The Accounting Review* 50 (October): 657-70.
- Almon, A. 1965. The distributed lag between capital appropriations and expenditures. *Econometrica* 33: 178-96.
- Belsley, D. A. 1991. *Conditioning Diagnostics: Collinearity and Weak Data in Regression*. John Wiley & Sons, New York.
- Ben-Zion, U. 1978. The investment aspect of nonproduction expenditures: An empirical test. *Journal of Economics and Business* (Spring/Summer): 224-29.
- Brennan, M. J. 1991. A perspective on accounting and stock prices. *The Accounting Review* 66 (January): 67-79.
- Bublitz, B., and M. Ettredge. 1989. The information in discretionary outlays: Advertising, research, and development. *The Accounting Review* 64 (January): 108-24.
- Cockburn, I., and Z. Griliches. 1988. Industry effects and appropriability measures in the stock market's valuation of R&D and patents. *American Economic Review Proceedings* 78: 419-23.
- Cohen, W., and R. Levin. 1989. Empirical studies of innovation and market structure. In *Handbook of Industrial Organization*, edited by R. Schmalensee and R. Willig, vol. 3. Elsevier Science Publications.
- FASB (Financial Accounting Standards Board). 1974. Accounting for Research and Development Costs Statement of Financial Accounting Standards No. 2. Stamford, CT: FASB.
- Grabowski, H., and D. Mueller. 1978. Industrial research and development, intangible capital stocks, and firm profit rates. *Bell Journal of Economics* 9: 328-43.
- Griliches, Z. 1981. Market value, R&D, and patents. *Economic Letters* 7: 183-87.
- Hall, B. H. 1988. The value of intangible corporate assets: An empirical study of the components of Tobin's Q. NBER and University of California at Berkeley.
- _____, C. Cummins, E. Laderman, and J. Mundy. 1988. The R&D Master File Documentation. NBER Technical Working Paper No. 72, December.
- Hatanaka, M. and T. D. Wallace. 1980. Multicollinearity and the estimation of low-order moments in stable lag distributions. In *Evaluation of Econometric Models*, edited by J. Kmenta and T. D. Wallace, 323-89. New York: Academic Press.

- Hirschey, M. 1982. Intangible capital aspects of advertising and R&D expenditures. *Journal of Industrial Economics* 30: 375-90.
- _____, and J. Weygandt. 1985. Amortization policy for advertising and research and development expenditures. *Journal of Accounting Research* 23:326-35.
- Johnson, J. 1967. A consequential approach to accounting for R&D. *Journal of Accounting Research* (Autumn): 164-72.
- Johnston, J. 1984. *Econometric Methods*. 3rd Edition. New York: McGraw Hill.
- Lev, B. 1989. On the usefulness of earnings and earnings research. Lessons and directions from two decades of empirical research. *Journal of Accounting Research* 27 (Supplement): 153-92.
- _____, and S. Sunder. 1979. Methodological issues in the use of financial ratios. *Journal of Accounting and Economics* 1: 187-210.
- Maddala, G. S. 1977. *Econometrics*. McGraw Hill, New York.
- Milburn, A. 1971. An empirical study of the relationship of research and development expenditures to subsequent benefits. Department of Accountancy, University of Illinois.
- Newman, M. 1968. Equating return from R&D expenditures. *Financial Executive* (April): 26-33.
- Ohlson, J. A. 1989. Accounting earnings, book value, and dividends: The theory of the clean surplus equation. Working paper, Columbia University, New York, NY.
- Omer, T. C., K. H. Molloy, and D. A. Ziebart. 1991. Measurement of effective corporate tax rates using financial statement information. *The Journal of the American Taxation Association* 13 (Spring): 57-72.
- Ravenscraft, D., and F. M. Scherer. 1982. The lag structure of returns to research and development. *Applied Economics* 14: 603-20.
- Scholes, M. S., and M. A. Wolfson. 1992. *Taxes and Business Strategy: A Planning Approach*. Englewood Cliffs, NJ: Prentice-Hall.
- Shevlin, T. 1990. Estimating corporate marginal tax rates with asymmetric tax treatment of gains and losses. *The Journal of the American Taxation Association* 12 (Spring): 51-67.
- _____. 1991. The valuation of R&D firms with R&D limited partnerships. *The Accounting Review* 66 (January): 1-21.
- White, H. 1980. The heteroscedasticity-consistent covariance matrix estimator and a direct test for heteroscedasticity. *Econometrica* 48 (May): 817-38.

A FORUM ON ACCOUNTING FOR
NOT-FOR-PROFIT ORGANIZATIONS

Yaw M. Mensah, Judith M. Considine, and Leslie Oakes
Statutory Insolvency Regulations and Earnings
Management in the Prepaid Health-Care Industry

Leslie Eldenburg
The Use of Information in Total Cost Management

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Perceived Social Needs, Outcomes Measurement, and
Budgetary Responsiveness in a Not-for-Profit Setting:
Some Empirical Evidence

Statutory Insolvency Regulations and Earnings Management in the Prepaid Health-Care Industry

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SYNOPSIS AND INTRODUCTION: Although health-care reform has emerged recently as an important national priority, there has been little research on the effect of possible deficiencies in both accounting and auditing standards in the development of problems in this area. This study examines earnings management in the health maintenance organization (HMO) sector of the prepaid health-care industry. HMOs are a principal component of the managed health-care concept currently being promoted as important in controlling escalating health-care costs.

The study examines possible strategic behavior by HMO management in the accrual of "incurred but not reported expenses" (IBNRs). IBNRs are the costs of medical care provided to HMO enrollees during a given year but not yet reported to the HMO by the fiscal year-end. They consist primarily of five components: accrued inpatient hospitalization costs, accrued primary physician costs, accrued costs from medical specialists to whom HMO enrollees have been referred, accrued medical incentive pool payments, and other miscellaneous medical costs. Their accrual was first recommended by the Health Maintenance Organization Task Force of the American Institute of Certified Public Accountants in an issues paper later published as an exposure draft (AICPA 1985). It was eventually released as SOP 89-5 entitled *Financial Accounting and Reporting by Providers of Prepaid Health Services* in 1989 to be effective for fiscal years beginning on or after 15 June 1989 with earlier application

We would like to express our appreciation to Carol Philpot and Healthcare Investment Analysts, Baltimore, Maryland, for providing us with the data. This paper has benefited greatly from the detailed comments of an associate editor and the two anonymous reviewers of this journal. We also appreciate the useful insight provided by participants at the Rutgers University accounting seminar.

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encouraged. However, by the time SOP 89-5 was issued, a significant majority of HMOs was already in compliance with the SOP, at least so far as the accrual of IBNRs was concerned.

The results of this study suggest that IBNRs may have been used as part of a strategic response by HMO management to events specific to the industry in the 1986-1989 period. These events included the outbreak of a premium war apparently waged to obtain market share at the expense of immediate profitability and the enactment in many states of minimum net worth regulations designed to prevent the resultant increase in financial failures among HMOs.

The results suggest that the IBNRs were systematically understated by financially weaker HMOs (relative to their stronger counterparts) in order to minimize regulatory costs associated with the statutory minimum net worth requirements imposed by some states during this period. Furthermore, the results were also consistent with the political visibility hypothesis, which theorizes that highly profitable firms in politically sensitive sectors seek to reduce their visibility by adopting income-decreasing accounting methods and discretionary accruals. However, the findings were not consistent with the political visibility hypothesis if size is visualized as a proxy for political visibility.

Key Words: *Earnings management, Health maintenance organizations, IBNRs, Political cost hypothesis.*

Data Availability: *The data used in this study are available commercially from the Healthcare Investment Analysts, Baltimore, Maryland.*

The data had been obtained by my two co-authors from the predecessor firm (American International HealthCare) apparently with some explicit restrictions on further distribution for any purpose. The successor firm, Healthcare Investment Analysts, has the data available commercially. There may be an educational discount for researchers, however.

THE paper is organized as follows. In section I, we present the institutional framework, including an overview of the HMO industry and the regulatory environment. In section II, we present a model of the determinants of the discretionary and nondiscretionary components of the ratio of IBNR to total medical expenses. The results and conclusions of the paper are presented in the final two sections.

I. Background of Study

Evolution and Regulation of the HMO Industry

HMOs are health-care organizations that act as intermediaries between the public and health-care providers. They emerged on the national health-care scene when the Nixon administration persuaded Congress to pass the HMO Act of 1973 (Public Law 93-222).

Although some HMOs operate their own health-care facilities, most act as health insurers by collecting premiums from enrollees (or from employers of the enrollees) and guaranteeing comprehensive medical coverage through contractual arrangements with health-care providers (physicians and hospitals). In theory at least, HMOs (as well as other managed health-care entities like preferred provider organizations, PPOs) provide a more appropriate setting for controlling health-care costs by precommitting enrollees to prepaid premiums while imposing strict utilization controls on the comprehensive set of health benefits offered (Gruber et al. 1988).

Fierce competition for market share and the desire for rapid growth resulted in large losses for a majority of HMOs in the years 1986 and 1987. To gain and/or maintain their market share, many HMOs deliberately reduced premiums. This reduction resulted in insufficient revenues to cover medical expenses, much less their administrative and marketing costs. As reported in the 1987 annual report of United Healthcare Corporation, a national HMO chain: "The [HMO] industry's principal difficulty in 1987 was controlling losses in the face of tremendous price competition, while medical costs continued to increase" (p. 2). This situation did not improve markedly until 1989.

In response to the escalating crisis in the HMO industry, a number of states followed the lead of the federal government and passed legislation mandating minimum net worth standards for HMOs operating in the state. The legislation typically empowered the respective state regulators to prohibit HMOs in violation of these minimum net worth standards from doing business in that state. In a survey conducted by two of the authors in 1989, it was found that 35 states had adopted such legislation by the end of 1987. The federal government's Office of Health Maintenance Organizations had long enforced minimum financial standards designed to ensure that federally qualified HMOs were adequately capitalized. These minimum solvency standards are intended primarily to protect enrollees for a minimum period during which they can shift to another insurer should financial difficulties arise for an individual HMO.¹

Suitability of IBNR as Earnings Management Tool

The minimum solvency standards imposed by the states and the federal government can be viewed as imposing regulatory costs on most HMOs since these standards may exceed what individual HMO management may perceive to be optimal. One way to minimize these regulatory costs is to understate the IBNRs in order to report a higher income and net worth for a given period. Such a reaction to the imposition of regulatory costs is entirely consistent with the positive accounting literature dealing with the determinants of accounting method choice (Watts and Zimmerman 1978, 1990).

In a recent synthesis of this literature, Christie (1990) identified the main underlying theories as the political visibility hypothesis, the debt contracting cost hypothesis, and

¹ Federal qualification was solicited by most HMOs in the early seventies because of federal grants and low-interest loans made available by the Nixon administration to promote the growth of HMOs. By the mid-eighties, however, these grants and loan programs had been phased out, and federal qualification was seen as a hindrance to effective competition because of the requirement to use the "community rating" system for setting premium rates (Langwell 1990). The federal minimum solvency standards require HMOs to maintain in restricted cash reserves an amount equal to two months' worth of average medical expenses. The restricted cash reserves are reduced by \$100,000 for every \$250,000 of net worth above \$5 million (or \$1 million if the book value of land, buildings, and equipment is excluded). The cash reserve requirement is relaxed if the HMO is an affiliate of a larger (insurance) company that guarantees the HMO's indebtedness (Joffe 1985).

the managerial self-interest (or agency) hypothesis. The debt contracting cost hypothesis posits that the possibility of violating restrictions in debt covenants influences a firm's choice of accounting methods. The managerial self-interest hypothesis theorizes that the choice of accounting methods is influenced by, among other things, the structure of management's compensation scheme.² Of direct relevance to this study are the findings reported by Moyer (1990) that the managers of commercial banks responded to new capital adequacy regulations by reducing their discretionary provisions for loan losses and loan charge-offs. Given these findings by Moyer (1990) and also Baber et al. (1991), it is reasonable to hypothesize that HMO management may have responded similarly to the statutory minimum net worth regulations.

Granted that HMO managers have incentives to manage earnings similar to those faced by managers in other industries, the accrual accounting tools available need to be examined. The nature of the HMO industry restricts the applicability of many of the earnings management techniques available in many other industries. Medical expenses are the principal expense category for HMOs, accounting for an average of 75 percent of total expenses for the period under study (with marketing and administrative expenses accounting for the rest). If the IBNRs are excluded, the remaining medical expenses represent mostly cash outlays made during the period. IBNRs account for between 8 and 13 percent of total medical expenses but represent between 70 and 90 percent of accounting accruals and are the principal accrual subject to discretionary estimates.³ Consequently, it provides the most cost-effective accrual accounting means for reducing the regulatory costs.

Moreover, the poor financial reporting and auditing practices detailed by Robbins and Ingram (1987) and Ingram and Robbins (1987) suggest that such managerial actions may have been difficult for state regulators to control. State regulators often lack the legal authority to restate the financial reports filed by HMOs, or they may be understaffed and/or lack the necessary accounting and actuarial expertise (Kenkle 1988). Furthermore, while this financial reporting situation was improved with the issuance of the AICPA's SOP 89-5, it is doubtful that the regional and local auditors who dominate the industry could have acquired sufficient expertise after the exposure draft was issued in 1986 to seriously challenge management's estimate of IBNRs by 1989. In fact, the AICPA's guidelines for auditing IBNRs encourage the auditor to hire an actuary if the estimated claim liability is material (AICPA 1990, 98-103).

II. Model of Determinants of Strategic Behavior

For consistency of terminology, IBNR will be referred to in the rest of this paper as *IBME* (i.e., the ratio of IBNR to total medical expenses). *IBME* has an intuitive interpretation as the ratio of the estimated unbilled medical expense to total medical expenses. Moreover, the deflation of IBNR by total medical expenses removes size differences among the HMOs as shown in the discussion that follows.

² The usual proxies used are financial leverage for the debt contracting hypotheses, profitability and size for the political visibility hypothesis, and existence of management bonus schemes for the managerial self-interest hypothesis. See Abdel-khalik et al. (1989) and Schipper (1989) for a discussion of issues in earnings management research.

³ The other accruals are depreciation expenses (for both medical and administrative facilities), which typically accounts for between 10 and 15 percent of the accruals and accruals for selling and administrative expenses and medical claims payable.

Institutional Factors

Three institutional aspects of the HMO industry need to be studied in the context of the choice of accounting policies as possible confounding factors. These are the model type, affiliation status, and for-profit status.

HMOs may be differentiated according to HMO model type. In the staff model, the HMO directly employs the health-care providers in centralized locations. The group model is similar to the staff model in that the HMO again uses centralized locations. However, unlike the staff case, the health-care professionals are not employees; instead they are regarded as independent contractors. In the network model, an HMO enters into contracts with physicians on a group basis to provide health-care services on a nonexclusive basis to the HMO's members. The IPA (Independent Practice Association) model differs from the network model only to the extent that the physicians contract with the HMO on an individual rather than a group basis (Robbins and Ingram 1987).

A second relevant institutional factor is the affiliation status of the HMO. The rapid growth of this sector has helped to foster the development of HMO chains, some of which are national in scope. The financial reports filed by HMOs operating in individual states are the focus of the analysis. Since the parent organization may exert pressure on the affiliate to manage earnings in accordance with the needs of the parent, the affiliation status of the HMO should be controlled in a study of possible earnings management.

Finally, the for-profit/nonprofit status of the HMO should be considered. While most of the HMOs established initially in the 1970s were nonprofit organizations, the desire for easy access to capital markets to finance expansion led to a series of conversions of nonprofit HMOs to for-profit status (Royalty 1991). The rapid growth of the sector also attracted for-profit firms that were already engaged in other areas of the health-care industry. The existence of both nonprofit and for-profit entities in this sector necessitates consideration of possible differences in managerial response to the environmental stimuli provided by the events of this period (see, for example, Newhouse 1970; Hansmann 1980).

Since model type, affiliation, and for-profit/nonprofit status are potential confounding factors, their possible effects are explicitly incorporated in the model presented below.

Hypothesized Determinants of Nondiscretionary IBME

As is typical in earnings management studies (e.g. McNichols and Wilson 1988), we assume that the reported *IBME* can be decomposed into a structural or nondiscretionary component and a discretionary component (ψ_i), i.e.:

$$IBME_{it} = IBME_{it}^* + \psi_{it}, \quad (1)$$

where

$$\begin{aligned} IBME_{it}^* &= \text{nondiscretionary component of } IBME, \text{ and} \\ \psi_{it} &= \text{discretionary component of } IBME. \end{aligned}$$

Given access to only publicly available data, it may be impossible for an outside analyst to directly derive the absolute level of the nondiscretionary component of the *IBME* for any given HMO. Actuarial methods common to the insurance industry are generally used to derive this estimate, utilizing assumptions about population demographics as well as specific information on the rate of new enrollments and similar data. However, it is not necessary to duplicate the steps followed by HMO management in deriving their estimates in order to be able to infer possible earnings management actions in a cross-sectional context.

It can reasonably be presumed that in determining the level of *IBME*, HMO management operates within two constraints: (1) the magnitude of the one-period change in the reported *IBME* (denoted $\Delta IBME$), and (2) the deviation of the reported *IBME* from its peers (HMO model type) during the current period ($\delta IBME$). For example, understating last year's *IBME* would reduce management's ability to do so in the current period. At the same time, the larger the deviation of the estimated *IBME* from the mean for that HMO model type, the greater the likelihood that an external auditor utilizing industry statistics might question that estimate. In essence, management's choice of $IBME_{it}$ for this period endogenously determines both the deviation from last year's *IBME* ($\Delta IBME$) and the deviation from the cross-sectional mean of *IBME* for that model type ($\delta IBME$). This permits a researcher to focus on modeling the relationship between $\Delta IBME$ and $\delta IBME$ as two endogenous variables determined simultaneously by management's choice of the *IBME* to report.

The structural factors hypothesized to be related to cross-sectional differences in $\Delta IBME$ and $\delta IBME$ are (1) the institutional or confounding factors discussed earlier, (2) the rate of growth in medical costs per member-month (g_{ME}), and (3) the rate of growth in total membership of the HMO (g_{MB}). The rate of growth in medical costs per member-month is expected to be an important determinant of both $\Delta IBME$ and $\delta IBME$ because it reflects the degree of inflation in medical costs experienced by a specific HMO over the reporting period. Intuitively, the higher the rate of change in medical costs faced by an HMO, the greater the difficulty likely to be encountered in predicting the *IBMEs* (particularly if the inflation rate is nonconstant over the year). To allow for possible nonlinearity in the relationship, the square of this growth rate (denoted g_{ME}^2) was used in the analysis.

The rate of growth in membership is important principally as a proxy for two other factors for which no direct information is available: (1) the rate of turnover in total membership; and (2) the rate of turnover in health-care providers. The greater the turnover in membership, the greater the difficulty in estimating the demand for medical services of the incoming membership due to possible changes in demographics, etc. Furthermore, the greater the rate of growth in membership, the greater the likelihood of additions to the set of health-care providers. This in turn will create greater uncertainty in estimating the timeliness of the billing from the incoming physicians and hospitals. The square of this growth rate (denoted g_{MB}^2) was used in this case as well to allow for possible nonlinearity.⁴

From the foregoing discussion, the following generic relationships can be specified for changes in this unobservable "true" $IBME_{it}^*$:

$$\Delta IBME_{it}^* = f[D(I)_{it}, g_{ME}^2, g_{MB}^2] \quad I = 1, \dots, 3 \quad (2)$$

where $\Delta IBME^*$ = one-period change in the unobservable (nondiscretionary) $IBME^*$,

$D(1)_{it}$ = dummy variable for for-profit status (=1 for-profit, 0 otherwise),

$D(2)_{it}$ = dummy variable for affiliation status (=1 affiliated, 0 otherwise),

$D(3)_{it}$ = dummy variable for model type (=1 for IPA/Network, 0 otherwise), and

$f[\cdot]$ denotes a generic functional relationship.

Since the observed value of $\Delta IBME$ is influenced by the unobservable $IBME^*$, the following generic functional relationship can be specified:

$$\Delta IBME_{it} = f[\Delta IBME_{it}^*, \delta IBME_{it}, \Delta \psi_{it}] \quad (3)$$

$$= f[D(I)_{it}, g_{ME}^2, g_{MB}^2, \delta IBME_{it}, \Delta \psi_{it}] \quad (4)$$

⁴ To simplify the notation, the subscripts i and t for the growth term will be omitted.

Equation (4) specifies that the one-period change in the reported *IBME* is dependent on the structural factors that drive $\Delta IBME^*$, management's perceived limits on the discretionary estimate of *IBME* due to comparisons with the peers of the HMO (proxied by $\delta IBME$) and to changes in the underlying factors driving the earnings management effort ($\Delta \psi$).

Similarly, the following generic functional relationship can be specified for $\delta IBME$:⁵

$$\delta IBME_{it} = f[D(I), IBME'_{it}, \Delta IBME_{it}, \psi_{it}] \quad (5)$$

where

$$\delta IBME_{it} = IBME_{it} - \overline{IBME}_{kt} \quad (6)$$

$$IBME'_{it} = \overline{IBME}_{kt-1} * (g_{it}^{ME} \times g_{it}^{MB}); \quad (7)$$

$\overline{IBME}_{kt}$ = Cross-sectional mean of *IBME* for HMO Model type 'k' to which the HMO belongs (k values: 1=Staff; 2=Group; 3=Network; 4=IPA).

$IBME'_{it}$ as given in equation (5) is a proxy for $IBME^*$, the *IBME* expected in the absence of the earnings management effort. It is hypothesized to be the cross-sectional mean of *IBME* of that model type for the previous period adjusted for the multiplicative effect of the individual HMO's growth rates in medical expenses per member-month and total membership.⁶ Since management's choice of the reported *IBME* simultaneously determines $\Delta IBME$ and $\delta IBME$, equation (5) allows for that simultaneity by including $\Delta IBME$ as a factor in the determination of $\delta IBME$. The final component in equation (5) is the level of the discretionary factors theorized to be driving the earnings management effort (ψ).⁷

Hypothesized Determinants of Discretionary Component of IBME

The theorized determinants of the discretionary component of *IBME* are: (1) profitability, (2) size (enrollments), (3) the margin of safety above the states' minimum net worth requirements (for states with such regulation), (4) the excess of actual cash reserves over the federal cash reserve requirements (for unaffiliated federally qualified HMOs), and (5) the degree of financial leverage (for unaffiliated HMOs). For the sake of brevity, only the alternative hypotheses are presented. The null hypotheses are that the hypothesized variables have no explanatory power with respect to cross-sectional differences in either $\delta IBME$ or $\Delta IBME$.

1. Profitability/Competitive Effect Hypothesis

The traditional political visibility hypothesis posits that profitable firms seek to avoid regulation by using income-decreasing accruals more intensively than do less profitable firms. Applied to the HMO context, it can be argued that to the extent that premium rates may be regulated, profitable HMOs may seek to understate their *IBMEs* to a lesser degree than do other HMOs. Moreover, the overstatement of the *IBMEs* may also succeed in lowering

⁵ The mean of the *IBME* for each HMO's peer group was calculated after excluding that HMO's own *IBME*.

⁶ In extensive sensitivity tests performed using different specifications of the relationship, this multiplicative model performed best in terms of minimizing the forecast errors.

⁷ To simplify the subsequent discussion, the alternative hypotheses will be presented in terms of the level or magnitude of the discretionary factors relative to that of *IBME* ($\delta IBME$). Note, however, that regression coefficients derived from a level model are equivalent to those derived from the change or difference model. Indeed, they should be equal if the level model is properly specified and the regression coefficients (excluding the intercept) are temporally stable. See Christie (1987) and particularly Landsman and Magliolo (1988) for a detailed exposition of this subject.

the profile of the HMO and avoiding undue political visibility. This traditional view can be extended to infer that unprofitable HMOs have an incentive to understate their *IBMEs* to avoid reporting even larger losses and the associated negative publicity.

While these arguments imply a positive correlation between relative profitability and *IBME*, note that these are not the only reasons why such a positive relationship may be observed. Similar results can be expected from the operation of competitive market forces. From the perspective of costly private contracting, a perception of financial weakness may make third parties (e.g., physicians, hospitals, and employers of HMO enrollees) reluctant to enter into contracts with the ailing HMO. Physicians and hospitals may be hesitant to contract with the HMO unless additional guarantees of payment such as reinsurance are provided. Furthermore, many states have laws that seek to protect HMO members by requiring HMO contracts with physicians to contain "hold harmless" provisions that insulate enrollees from personal liability should the HMO fail financially. Health-care providers in states with such laws are likely to be particularly sensitive to the financial health of the HMOs with which they deal.

Similarly, employers of current and potential HMO enrollees (who bear most of the health insurance premium costs) may infer that current operating losses will require future premium increases. Employees may be encouraged to switch to profitable HMOs with similar benefit packages, thus making the reporting of large losses costly. The understatement of the *IBME* in a given year may provide an HMO with time to reduce its operating costs or obtain additional capital without an immediate penalty through lower enrollments. The combination of these factors leads to the following hypothesis:

H_{a1} : There is a positive association between relative profitability and the reported *IBME*.

Operationally, if RET_{it} is defined as the ratio of net income before taxes and the IBNR accrual to total revenues, then the coefficients obtained from the regression of ΔRET and RET on $\Delta IBME$ and $\delta IBME$, respectively, should be positive.⁸

2. Political Visibility (Size) Hypothesis

Along with profitability, size is also often used as a proxy for political visibility (Watts and Zimmerman 1978, 1990). That is, the larger the entity, the greater the political visibility and the threat of more restrictive regulations if large profits are reported. This leads to the inference that large, consistently profitable HMOs will have a lesser tendency to understate their *IBMEs* (and thus report true earnings) than will their smaller counterparts.

On the other hand, among consistently unprofitable HMOs, size should be positively related to the propensity to understate *IBMEs*. Specifically, as HMOs get larger and the social consequences of their financial failure increase, state regulators may pay more attention to their compliance with statutory minimum net worth requirements.⁹ *Ceteris paribus*, large, consistently unprofitable HMOs will have a greater tendency to understate their *IBMEs*

⁸ Because of systematic differences in asset base according to HMO model type, the traditional return on asset measure is not meaningful as an inter-HMO measure. The presence of nonprofit HMOs similarly renders the return on equity of limited value. For this reason, the most common profit measure in the industry is the return on revenue.

⁹ A reviewer has pointed out that an alternative explanation is also possible. That is, the management of large HMOs may operate under the assumption that large HMOs will not be allowed to fail because of the high social costs involved. If so, then there should be no relationship expected between size and the two dependent variables since management of such large HMOs will be indifferent to violation of the net worth standards.

than do their smaller counterparts. Finally, HMOs in transition to profitability may be expected to be averse to reporting losses in order to generate a more positive picture. Since large HMOs have the most to gain by convincing employers of existing enrollees that a turn-around has occurred and that large premium increases are unlikely in the immediate future, large HMOs in this category are expected to understate their *IBMEs* to a greater degree than do their smaller counterparts.

If the dummy variables *DPROFIT*, *DMIXED*, and *DLOSS* are used to denote consistently profitable, mixed performance, and consistently unprofitable HMOs, then alternative hypotheses for the political cost (size) effect can be stated as:

- Ha_{2,1}: *Ceteris paribus*, among consistently profitable (*DPROFIT*) HMOs, there is a positive relationship between size and *IBME*.
- Ha_{2,2}: Among HMOs with mixed performance (*DMIXED*), *ceteris paribus*, there is a negative relationship between size and *IBME*.
- Ha_{2,3}: Among consistently unprofitable (*DLOSS*) HMOs, *ceteris paribus*, there is a strong negative relationship between size and *IBME*.

Operationally, in regressions of δ *IBME* and Δ *IBME* on *SIZE* and Δ *SIZE*, respectively, the signs of the coefficients are expected to be positive for the *DPROFIT* subgroup, slightly negative (but statistically significant) for the *DMIXED* subgroup, and strongly negative for the *DLOSS* subgroup. The three hypotheses can be tested jointly by constructing interaction terms between *SIZE* and the three subgroups using the following operational definitions:

- $SIZE_t$ = common log of total membership at time *t*;
- $DPROFIT_t$ = 1 if net income > 0 for the years 1987-89, = 0 otherwise;
- $DMIXED_t$ = 1 if net income changed signs for any of the years 1987-89, = 0 otherwise;
- $DLOSS_t$ = 1 if net income < 0, = 0 otherwise.

3. Regulation Effects (States' Minimum Net Worth Standards)

Theoretically, from the perspective of governmental regulation, the principal potential consequence of failure to meet the minimum net worth requirements (in states where they exist) is involuntary dissolution or deregistration. Since these standards often involve the maintenance of a minimum net worth measured using generally accepted accounting standards, HMO management has a greater incentive to manage reported earnings as the HMO moves closer to a violation of the established minimum net worth standards.

The degree of responsiveness can also be hypothesized to differ among the three operating performance groups (i.e., *DPROFIT*, *DMIXED*, and *DLOSS*). Since the statutory minimum net worth standards are unlikely to pose a threat to the continued survival of HMOs in the *DPROFIT* group, these HMOs can therefore be hypothesized to be indifferent to the existence of these standards. In contrast, HMOs in the *DLOSS* subgroup are likely to be more sensitive to the degree of safety above the minimum net worth standards since continued erosion of the actual net worth through operating losses will decrease this margin. A response for the *DMIXED* group is expected to be stronger than for the *DPROFIT* group, but weaker when compared to the *DLOSS* group. This leads to the following hypotheses:

- Ha_{3,1}: For consistently profitable (*DPROFIT*) HMOs, the minimum net worth requirements have no effect on earnings management behavior as reflected in the *IBME* estimate.

- Ha_{3,2}: For HMOs with mixed performance (*DMIXED*), the degree of safety relative to the minimum net worth requirements is positively related to the *IBME* estimate.
- Ha_{3,3}: For consistently unprofitable (*DLOSS*) HMOs, the degree of safety relative to the minimum net worth requirements is strongly and positively related to the *IBME* estimate.

If the degree of safety is defined as the signed distance of actual net worth from the minimum net worth requirements, then a joint test of these hypotheses can be performed with the three dummy interaction terms: $(DNW \cdot DPROFIT)_i$, $(DNW \cdot DMIXED)_i$, and $(DNW \cdot DLOSS)_i$ where $DNW_i = (\text{Actual net worth} - \text{Minimum net worth required}) / \text{Total medical expenses}$. The coefficient for $DNW \cdot DLOSS$ is expected to be positive and to exceed in magnitude a similarly positive coefficient for $DNW \cdot DMIXED$. The coefficient for $DNW \cdot DPROFIT$ is expected to be not statistically different from zero. Identical expectations hold for the coefficients from the change ($\Delta IBME$) model.

4. Regulation Effect (Federal Insolvency Requirements)

In addition to the regulation effect attributable to the minimum net worth standards, we further hypothesize that HMOs that are federally qualified would seek to maintain such federal qualification.¹⁰ Consequently, the minimum cash reserve requirements imposed by the federal Office of Health Maintenance Organizations will be observed. As discussed earlier, these requirements are a function of the actual cash reserve position and reported medical expenses. Since the requirements are applied only at the parent organization level, only unaffiliated HMOs are likely to be faced with the possible violation of this requirement. The hypothesis can thus be stated as:

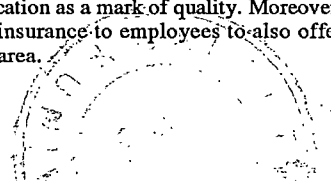
- Ha₄: For federally qualified, unaffiliated HMOs, there is a positive association between the reported *IBME* and the proximity of actual cash reserves to the federal minimum cash reserve requirements.

To operationalize this hypothesis, a variable FCR_i was defined for federally qualified, unaffiliated HMOs as the difference between the actual cash reserves and minimum cash reserves required under the federal insolvency guidelines divided by total medical expenses. The coefficient for FCR_i is expected to be positive.

5. Debt Contracting Cost Hypothesis

The existence of debt on the balance sheet of any entity can be presumed to lead to the incurrence of debt contracting costs. Specifically, creditors may impose conditions on the entity through accounting-based debt covenants. A consistent research finding has been that financial leverage, as a proxy for these restrictions, frequently is a significant factor in explaining the managerial choice of accounting reporting standards and the provision of discretionary accruals (Watts and Zimmerman 1990; Christie 1990). That is, the degree of financial leverage is frequently found to be negatively associated with the likelihood of adoption of income-decreasing methods and the overestimate of discretionary accruals.

¹⁰ Although federal qualification is no longer perceived to be the advantage that it was in the 1970s and early 1980s when low cost loans were available, some HMOs still seek such qualification as a mark of quality. Moreover, federal law requires employers who offer the traditional health indemnity insurance to employees to also offer the HMO option only if a federally qualified HMO offers coverage in that area.



In the context of HMOs, since the reporting entities are not necessarily independent, financial leverage may not be meaningful in all cases. Affiliated HMOs may report little or no debt, even though the parent organization may be heavily leveraged. Consequently, financial leverage as defined in this study is limited only to independent HMOs. The hypothesis tested can be formally stated as follows:

Ha₃: *Ceteris paribus*, there is a negative relationship between leverage and *IBME* among unaffiliated HMOs.

Operationally, if $LEVU_{it}$ represents financial leverage (defined as total liabilities excluding the IBNR estimate divided by total assets) for the unaffiliated HMOs, then its regression coefficient is expected to have a negative sign.

Overall Model

The overall system of simultaneous equations was derived by substituting the hypothesized determinants of the discretionary component of *IBME* into equations (4) and (5) and writing them out as linear functions. Specifically:

$$\begin{aligned} \Delta IBME_{it} = & \alpha_0 + \sum_{I=1}^3 \alpha_{0I} D(I) + \alpha_1 (\delta IBME_{it}) + \alpha_2 (g_{ME}^2) + \alpha_3 (g_{MB}^2) + \gamma_1 (\Delta RET_{it}) \\ & + \sum_{J=1}^3 \gamma_{2J} [\Delta SIZE(J)_{it}] + \sum_{J=1}^3 \gamma_{3J} [\Delta DNW(J)_{it}] + \gamma_4 (\Delta FCR_{it}) \\ & + \gamma_5 (\Delta LEVU)_{it} + e_{it} \end{aligned} \quad (10)$$

$$\begin{aligned} \delta IBME_{it} = & \alpha_0 + \sum_{I=1}^3 \alpha_{0I} D(I) + \alpha_1 (\Delta IBME_{it}) + \alpha_2 (IBME'_{it}) \\ & + \gamma_1 (RET_{it}) + \sum_{J=1}^3 \gamma_{2J} [SIZE(J)_{it}] + \sum_{J=1}^3 \gamma_{3J} [DNW(J)_{it}] \\ & + \gamma_4 (FCR_{it}) + \gamma_5 (LEVU)_{it} + e_{it} \end{aligned} \quad (11)$$

where $D(1)$ = Dummy variable for for-profit status (1 = for-profit, 0 nonprofit),
 $D(2)$ = Dummy variable for affiliation status (1 = affiliated, 0 unaffiliated),
 $D(3)$ = Dummy variable for HMO model type (1 = IPA/network, 0 otherwise),
 $SIZE(1)_i = SIZE_i * DPROFIT_i$; $SIZE(2)_i = SIZE_i * DMIXED_i$; $SIZE(3)_i = SIZE_i * DLOSS_i$;
 $DNW(1)_i = DNW_i * DPROFIT_i$; $DNW(2)_i = DNW_i * DMIXED_i$; and $DNW(3)_i = DNW_i * DLOSS_i$.

III. Results of Analyses

Source of Industry Data

Given the relative lack of data on the HMO industry easily available to researchers, the source of the industry data used in this study and its possible limitations need to be

discussed. The data were originally obtained from a database compiled by American International Healthcare (since acquired by Healthcare Investment Analysts) from several sources including state regulators and the Federal Health Care Financing Administration's Office of Prepaid Health Care.

Although, according to American International Healthcare, the database covers all HMOs in the industry, HMO filings with the state regulatory agencies are sometimes incomplete. Thus, there are missing fields in the database for many HMOs who may have data in other fields for some years. Altogether, there were 616, 698, 680, and 520 HMOs for the years 1986 to 1989 on the database. Of this total, however, only 455 HMOs had complete financial statement data over the years 1987 to 1989; the discontinuities presumably exist because of mergers, failures, and other sources of turnover. Of this 455, only 382 HMOs were accruing *IBMEs* over this period and had the enrollment data needed for the analysis proposed for this study.¹¹

An analysis of the database provides adequate evidence of the financial pressures exerted on the HMOs in the 1986-1989 period. For example, 45 HMOs reported negative net worth in 1986, while 162 did in 1987.¹² These figures dropped to zero in 1988, and then increased to 60 in 1989. Of the 382 HMOs that survived the screening, 39, 97, and 54 reported negative net worth in the years 1986, 1987, and 1989, respectively. Evidence of an intensive recapitalization effort in 1988 can be gathered from the fact that none of the financial statements filed with the state regulatory agencies showed negative net worth in that year. This recapitalization effort was undoubtedly due to the minimum net worth regulations passed by many state legislatures in late 1986 and 1987 as discussed earlier. The reemergence of HMOs with negative net worth in 1989 provides *prima facie* evidence of the continuing competitive turmoil in the industry even at that late date.

Table 1a presents summary statistics on profitability, total revenues, total enrollments, and the ratio of medical expenses to revenues for the HMO industry as presented on the database for the years 1986 to 1989. Although the data are presented only for HMOs with the requisite continuous data, the results present a representative view of the difficulties faced by the industry in the years of interest in this study. By 1989, the industry as a whole appeared to have moved gradually toward profitability; however, some HMOs were still in financial difficulty.¹³

Table 1b presents the frequency distribution of the 455 HMOs in the database according to several criteria. From this table, it is clear that a significant majority of the HMOs (402 out of 455) was accruing IBNRs by 1987. Moreover, all the affiliated HMOs were accruing IBNRs by the time the exposure draft preceding SOP 89-5 was released in 1986. Among other facts evident from table 1b are the following: the IPA/network model type was the dominant type of HMO, and for-profit HMOs slightly outnumbered the nonprofit HMOs. In the interest of brevity, a complete analysis of the year-by-year analysis of *IBME* by HMO model type is omitted. However, such an analysis shows that *IBME* averaged

¹¹ The breakdown of the sample by state and the specific minimum solvency requirements by individual states have been omitted for the sake of brevity and are available from the authors.

¹² The data for 1986 are very sketchy so the actual number of HMOs with negative net worth may be much higher than is reported here.

¹³ Detailed analysis of the data for the states with minimum net worth standards in effect provides some additional insight. Seventy-five HMOs violated their respective net worth standards in 1987 only, one in both 1987 and 1988, 61 in both 1987 and 1989 (with no violation in the intervening year), and three in both 1988 and 1989. However, 20 HMOs were in continuous violation from 1987 to 1989. Follow-up data on the fate of these HMOs after 1990 are not available, but the fact that they continued in existence suggests that state regulators in the eight states in which these 20 operated may have been rather lenient in enforcing the standards.

Table 1a
Analysis of HMO Industry Statistics by Year
(Limited to HMOs with requisite data for the years 1987-1989 on AIH Database)

	1986	1987	1988	1989
<i>Net Income/Total Revenue</i>				
Mean	-0.31	-0.28	-0.12	-0.03
Standard Deviation	0.71	0.63	0.27	0.12
Minimum	-4.49	-4.92	-3.00	-1.40
Maximum	0.62	0.60	0.19	0.20
Sample size *	345	455	455	455
<i>Total Revenue (in \$M)</i>				
Mean	32.02	40.16	51.11	62.60
Standard Deviation	58.93	68.43	84.26	102.65
Minimum	0.0030	0.19	0.97	0.20
Maximum	468.31	499.58	601.56	833.10
<i>Medical Expenses/Revenues</i>				
Mean	0.87	0.91	0.91	0.87
Standard Deviation	0.20	0.16	0.12	0.11
Minimum	0.09	0.04	0.37	0.11
Maximum	2.67	1.69	1.38	1.76
<i>Net Worth (in \$M)</i>				
Mean	**	1.95	15.14	3.54
Standard Deviation	**	8.24	30.93	10.29
Minimum	**	-32.21	0.15	-61.57
Maximum	**	80.07	283.30	88.63
<i>Total Enrollment (in 000)</i>				
Mean	45.65	49.04	56.02	55.96
Standard Deviation	76.58	78.26	85.29	82.42
Minimum	0.09	0.33	0.89	0.32
Maximum	720.80	720.90	739.91	740.82
Sample Size	319	417	454	451

Note: AIH = American International Healthcare

* Sample size given applies to all data given below except total enrollment

** Insufficient data on AIH database to derive meaningful summary statistics

Table 1b
Analysis of Distribution of HMOs in Database by IBNR Accrual Status
(Contingency table by year)

	1986		1987		1988		1989	
	Non-IBNR	IBNR	Non-IBNR	IBNR	Non-IBNR	IBNR	Non-IBNR	IBNR
Profitability								
Negative NIBA	135	129	34	181	27	147	13	48
Positive NIBA	13	178	19	221	19	262	30	364
Total	148	307	53	402	46	409	43	412
Chi-Square	99.23		6.87		9.07		11.58	
Probability	0.001		0.009		0.003		0.001	
For-profit/Nonprofit Status								
For-profit	92	190	24	257	21	260	22	261
Nonprofit	56	117	29	145	25	149	21	151
Total	148	307	53	402	46	409	43	412
Chi-Square	0.03		6.89		5.62		2.5	
Probability	0.933		0.009		0.018		0.117	
Affiliated/Unaffiliated Status								
Unaffiliated	148	160	53	255	46	262	43	265
Affiliated	0	147	0	147	0	147	0	147
Total	148	307	53	402	46	409	43	412
Chi-Square	104.69		28.63		24.42		22.67	
Probability	0.001		0.001		0.001		0.001	
Staff /Group vs. IPA/Network								
Staff/Group	33	68	21	80	19	78	16	81
IPA/Network	115	239	32	322	27	331	27	331
Total	148	307	53	402	46	409	43	412
Chi-Square	0.001		10.55		12.19		7.2	
Probability	0.972		0.001		0.001		0.008	
Federal Qualification Status								
Not Qualified	102	137	34	205	30	205	29	206
Qualified	46	170	19	197	16	204	14	206
Total	148	307	53	402	46	409	43	412
Chi-Square	23.64		3.25		3.77		4.74	
Probability	0.001		0.071		0.051		0.029	

Notes: HMO = Health Maintenance Organization
 IBNR = Incurred But Not Reported Expenses
 NIBA = Net Income Before IBNR accrual and income taxes.
 IPA = Individual Practice Association

8.2 percent, 7.1 percent, 10.9 percent, and 15.8 percent for the staff, group, network, and IPA model types, respectively.

Summary Statistics on IBME Accrual Sample

To assess the earnings management hypothesis outlined earlier, the sample was restricted to only the 382 HMOs that accrued IBNRs and had complete financial statement data for the years 1987 to 1989. The data for 1988 and 1989 were pooled (data for 1987 were lost due to lagging) to form a cross-sectional, time-series sample. The original 764 observations were reduced to 723 after 41 observations were deleted as outliers because of extreme or implausible values for some variables.¹⁴ To provide some perspective on the results, summary statistics on the key variables used in the analyses are presented in tables 2 and 3.

The results in table 2 are presented for the entire sample and also by the consistency of profit performance groupings: *DPROFIT*, *DMIXED*, and *DLOSS*. There were 106, 356, and 261 observations in the three classifications, respectively. Note that the average deviation from the model type mean ($\delta IBME$) is 0.002, while the average change from the prior year's *IBME* ($\Delta IBME$) is 0.012. However, the mean *IBME* as reported is 0.148. The means of the squared growth rates for medical costs per member-month and membership (1.238 and 1.670 respectively) indicate average medical cost inflation rate of 11.2 percent per annum and average enrollment increases of 29.2 percent. However, the range of the data indicates a considerable dispersion around these mean values.

One interesting inference that can be drawn from the results in table 2 is the economic significance of the relative understatement of the *IBMEs*. For the three subgroups (*DPROFIT*, *DMIXED*, and *DLOSS*), the mean differences in the forecasted error ($IBME^{FE} = \text{reported } IBME \text{ less predicted } IBME'$) are -0.065, -0.061, and -0.111. This result suggests that, despite an upward bias in the prediction model for *IBME*, the *IBMEs* for the *DLOSS* subgroup have been understated relative to those of the other two subgroups. Moreover, the degree of understatement is sufficient to cover any deficiencies in meeting the minimum net worth requirement. Note that for *DLOSS* HMOs, the difference between the actual net worth and the minimum net worth standard deflated by total medical expenses (DNW) is 0.103, while the mean $IBME^{FE}$ is -0.111. This suggests that if the HMOs in the *DLOSS* subset were compelled to record *IBMEs* using the forecasted $IBME'$, their mean DNW would be -0.008 (i.e., 0.103 less 0.111). In contrast, similar mean scores for the *DPROFIT* and *DMIXED* subgroups are 0.167 (0.232 less 0.065) and 0.084 (0.145 less 0.061), respectively. Thus, only the *DLOSS* HMOs would have been in outright violation of the minimum net worth standards. These results also show that the understatement of the *IBMEs* may be of sufficient importance to affect regulatory decisions.

Table 3 presents a frequency distribution of the pooled sample by dummy variables used in the study. Of the 723 observations, 470 were for-profit, and 429 were unaffiliated. In terms of model types, 70, 62, 107, and 484 were of the staff, group, network, and IPA types, respectively. Finally, 368 of the 723 observations were federally qualified. These

¹⁴ There were probably data errors of various kinds in the database. In about ten cases, for example, total liabilities were reported as negative amounts. Such values were deemed implausible and deleted from the analysis. Judging from the analysis of HMO reporting practices by Robbins and Ingram (1987), we are inclined to believe that these errors existed in the HMO filings with the state regulatory agencies and did not originate during the data compilation by AIH.

Table 2
Summary of Variables Used in Study

<i>Variables</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Minimum</i>	<i>Maximum</i>
<i>Panel A: Overall Sample</i>				
<i>Dependent Variables:</i>				
$\delta IBME_{it}$ (Deviation from mean)	0.002	0.273	-0.191	0.954
$\Delta IBME_{it}$ (Change from prior period)	0.012	0.329	-0.750	1.402
<i>Independent Variables (level)</i>				
$IBME_{it}$ (Predicted $IBME_{it}$)	0.214	0.146	0.001	0.954
g^2_{MB} (Growth in medical costs)	1.238	1.818	0.004	42.826
g^2_{MB} (Membership growth)	1.670	2.254	0.001	41.422
RET_{it} (Profitability)	0.063	0.019	-1.122	0.493
FCR_{it} (Deviation from federal cash requirement)	-0.013	0.066	-0.404	0.852
$(SIZE*DPROFIT)_{it}$ (size - $DPROFIT$)	0.202	0.299	-0.167	2.140
$(SIZE*DMIXED)_{it}$ (size - $DMIXED$)	0.198	0.594	-0.441	2.724
$(SIZE*DLOSS)_{it}$ (size - $DLOSS$)	0.110	0.940	-0.109	1.296
$(DNW*DPROFIT)_{it}$ (net worth - $DPROFIT$)	0.232	0.227	-0.161	1.136
$(DNW*DMIXED)_{it}$ (net worth - $DMIXED$)	0.145	0.235	-1.086	1.880
$(DNW*DLOSS)_{it}$ (net worth - $DLOSS$)	0.103	0.314	-1.002	0.796
$LEVU_{it}$ (Leverage - Unaffiliated)	0.365	0.276	0.001	1.895
<i>Independent Variables (Changes)</i>				
ΔRET_{it}	0.118	0.353	-0.540	2.316
ΔFCR_{it}	-0.013	0.066	-0.404	0.853
$\Delta (SIZE*DPROFIT)_{it}$	0.051	0.191	-0.125	3.202
$\Delta (SIZE*DMIXED)_{it}$	0.340	0.568	-1.465	3.578
$\Delta (SIZE*DLOSS)_{it}$	0.032	0.254	-3.353	2.308
$\Delta (DNW*DPROFIT)_{it}$	-0.007	0.122	-0.780	0.845
$\Delta (DNW*DMIXED)_{it}$	-0.065	1.201	-3.205	3.137
$\Delta (DNW*DLOSS)_{it}$	0.017	0.161	-2.932	1.796
$\Delta LEVU_{it}$	0.343	0.665	-0.473	0.848

(Continued)

Table 2 (Continued)

Profit Performance		Standard			
Variables	Grouping	Mean	Deviation	Minimum	Maximum
Panel B: Analysis of Other Key Variables by Profit Performance Grouping					
IBME _{it}	DPROFIT	0.109	0.096	0.001	0.424
	DMIXED	0.141	0.089	0.001	0.540
	DLOSS	0.117	0.087	0.003	0.286
IBME' _{it}	DPROFIT	0.174	0.096	0.031	0.610
	DMIXED	0.203	0.141	0.001	0.954
	DLOSS	0.229	0.187	0.014	0.947
δ IBME _{it}	DPROFIT	-0.026	0.097	-0.189	0.272
	DMIXED	-0.005	0.089	-0.191	0.413
	DLOSS	-0.029	0.079	-0.178	0.135
IBME ^{FE} _{it}	DPROFIT	-0.065	0.108	-0.481	0.176
	DMIXED	-0.061	0.151	-0.838	0.519
	DLOSS	-0.111	0.186	-0.918	0.152
RET _{it}	DPROFIT	0.125	0.093	0.006	0.460
	DMIXED	0.073	0.115	-0.670	0.493
	DLOSS	-0.167	0.171	-0.740	-0.003
FCR _{it}	DPROFIT	-0.016	0.061	-0.167	0.163
	DMIXED	-0.011	0.066	-0.167	0.853
	DLOSS	-0.022	0.083	-0.404	0.206

Notes: $IBME_{it}$ = $IBNR_{it}$ /Total medical expenses reported for period t ;

$IBME_{it}^{FE}$ = $IBME_{it} - IBME'_{it}$,

= Error in the prediction of the reported $IBME$;

$SIZE$ = Common log of total enrollments;

DNW = Deviation of actual net worth from the minimum net worth standards.

results show a highly diverse group with respect to all factors of interest in the HMO environment.

Table 4 presents analyses of the pairwise Spearman rank order correlations between the continuous variables in the system of simultaneous equations estimated. Since the Pearson product-moment correlations are similar, table 4 reports only the Spearman rank-order correlations, which are perhaps the most useful in this context since many of the variables have been truncated and bivariate normality assumed by the Pearson correlations is unlikely to hold in this context. As shown in table 4, many of the exogenous variables are correlated, with the correlations ranging as high as 0.43 (between $DNW*DLOSS$ and $SIZE*DLOSS$) and 0.51 (between g^2_{MB} and $\Delta SIZE*DLOSS$).

Zellner's seemingly unrelated regressions approach and its simultaneous equations extension, the 3-stage least squares (3SLS) approach of Zellner and Theil (1962), are often used in econometric studies to permit estimation of parameters where some degree of collinearity exists in the data. Their use is particularly common in production function studies where the inputs are often highly correlated. The availability of more than one equation to describe the phenomenon under study permits multicollinearity to be handled in a more satisfactory manner (Berndt 1991, 462-81). In this context, despite the degree of multicollinearity evident in table 4, the 3SLS approach was used to obtain more efficient estimates of the parameters than would have been possible using 2SLS (Pindyck and Rubinfeld 1981, 334).¹⁵

Results from Estimation of Simultaneous Equations

The results obtained when equations (7) and (8) were estimated are presented in table 5. Of the five hypothesized determinants of the discretionary component of the *IBMEs*, the findings offer support for three: the profitability/competitive effect hypotheses, the political visibility hypothesis relating to size, and the regulation effect due to the states' statutory net worth requirements. The results pertaining to the federal insolvency requirements and the leverage effect for unaffiliated HMOs were mixed.

The most consistent results for the hypothesized earnings management indicators in table 5 are those relating to the profitability/competitive effect hypothesis (H_{a1}). The expected statistically significant and positive sign for the coefficient for *RET* is observed in the equations for both $\Delta IBME$ and $\delta IBME$. Profitability is thus positively related to the magnitude of the one-period change in *IBME* and the deviation of the reported *IBME* for a given period from the peer group mean. This consistency offers some indication that relative profitability may have influenced HMO managers' choice of the *IBME* estimate.

Unfortunately, these results do not permit us to distinguish between the two reasons originally offered in support of the hypothesis. Under the traditional political cost hypothesis, profitable HMOs seek to overstate their *IBMEs* to reduce their political profile. An extension of that hypothesis leads to the "competitive effect," which suggests that unprofitable HMOs may seek to understate their *IBMEs* to avoid unfavorable competitive market reactions (from both medical providers and the employers of the enrollee population) to high reported losses. The highly significant and positive coefficient for *RET* and ΔRET in the two equations suggests that both of these reasons might have been operative.

The results of the test for the political visibility (size) effect are more ambiguous. Hypothesis $H_{a2,1}$, which relates to the consistently profitable subset (*DPROFIT*) offers the

¹⁵ The results discussed later confirm this: the 2SLS results always had higher standard errors than the 3SLS results, although the overall conclusions are not affected.

Table 3
Summary of Dummy Variables Used in
Analysis of HMOs' Earnings Management Efforts
(subclassified by HMO model type and profit performance groupings)

Dummy Variables		HMO Model Type				Total
		Staff	Group	Network	IPA	
Profit/Nonprofit Status						
For-profit	DPROFIT	6	4	18	34	62
	DMIXED	16	13	33	138	200
	DLOSS	6	8	14	180	208
Nonprofit	DPROFIT	14	6	4	20	44
	DMIXED	22	19	37	78	156
	DLOSS	6	12	1	34	53
Affiliation Status						
Unaffiliated	DPROFIT	16	8	12	36	72
	DMIXED	28	24	42	130	224
	DLOSS	8	6	9	110	133
Affiliated	DPROFIT	4	2	10	18	34
	DMIXED	10	8	28	86	132
	DLOSS	4	14	6	104	128
Federal Qualification Status						
Qualified	DPROFIT	12	4	14	35	65
	DMIXED	27	19	38	114	198
	DLOSS	6	16	5	78	105
Not Qualified	DPROFIT	8	6	8	19	41
	DMIXED	11	13	32	102	158
	DLOSS	6	4	10	136	156
Total		70	62	107	484	723

Notes: *DPROFIT* = Dummy variable for consistently profitable HMOs (1 = Net Income > 0 for all years; 0 = Otherwise);
DMIXED = Dummy variable for mixed case (1 = $NI_{it} > 0$ for some years and Net Income < 0 for other years; 0 = Otherwise);
DLOSS = Dummy variable for consistently unprofitable HMOs (1 = Net Income < 0 for all years; 0 = Otherwise).

Table 4
Analysis of Pairwise Spearman Rank Order Correlation among Predictor Variables in the
Study of the HMOs' Earnings Management Behavior

	Independent Variables									
	RET	LEVU	DNW1	DNW2	DNW3	SIZE1	SIZE2	SIZE3	FCR	IBME'
<i>Panel A: Levels of Variables</i>										
LEV*DU	0.01	1.00								
DNW*DPROFIT	0.18*	0.06	1.00							
DNW*DMIXED	-0.04	-0.30	-0.31*	1.00						
DNW*DLOSS	-0.16*	0.04	-0.04	-0.09+	1.00					
SIZE*DPROFIT	0.17*	0.11*	-0.15*	0.35*	-0.05	1.00				
SIZE*DMIXED	0.17*	-0.16*	0.02	0.38*	-0.15*	-0.60*	1.00			
SIZE*DLOSS	-0.36*	0.04	0.07	-0.21*	0.43*	-0.11*	-0.34*	1.00		
FCR	0.12*	-0.01	0.04	0.05	-0.02	0.01	-0.08+	-0.02	1.00	
IBME'	-0.18	-0.24*	-0.04	0.29*	0.11*	-0.09+	0.05	0.04	0.16*	1.00
Dependent Variable: δ IBME	0.33*	-0.28*	-0.06	0.20*	0.05	-0.11*	0.08+	0.04	0.15*	0.08+
<i>Panel B: Change in Variables</i>										
	Δ RET	Δ LEVU	Δ DNW1	Δ DNW2	Δ DNW3	Δ SIZE1	Δ SIZE2	Δ SIZE3	Δ FCR	δ^2_{ME} δ^2_{MB}
Δ LEV*DU	0.04	1.00								
Δ DNW*DPROFIT	0.01	-0.18*	1.00							
Δ DNW*DMIXED	-0.05	-0.50*	-0.01	1.00						
Δ DNW*DLOSS	0.03	-0.14*	-0.00	-0.00	1.00					
Δ SIZE*DPROFIT	-0.15*	-0.10+	0.06	0.01	0.00	1.00				
Δ SIZE*DMIXED	0.13*	-0.15*	0.01	0.09+	0.00	-0.16*	1.00			
Δ SIZE*DLOSS	0.25*	-0.02	0.00	0.00	0.21*	-0.02	-0.08+	1.00		
Δ FCR	0.05	-0.08+	-0.03	0.03	-0.01	-0.02	-0.02	-0.06	1.00	
δ^2_{ME}	-0.26*	0.24*	-0.26*	-0.34*	-0.13*	0.01	0.16*	0.02	0.00	1.00
δ^2_{MB}	0.19*	-0.10+	-0.02	-0.03	0.04	0.15*	0.51*	0.14*	-0.01	0.01
Dependent Variable: Δ IBME	0.38*	-0.04	0.02	0.01	0.08+	0.02	-0.04	0.01	0.12*	-0.09+
										-0.03

Notes: * Significant at a probability of less than 0.01.

+ Significant at a probability of less than 0.05.

The correlation between δ IBME and Δ IBME is 0.946.

SIZE1 = SIZE*DPROFIT; SIZE2 = SIZE*DMIXED; SIZE3 = SIZE*DLOSS;

DNW1 = DNW*DPROFIT; DNW2 = DNW*DMIXED; DNW3 = DNW*DLOSS.

Table 5
Results of 3SLS Estimation of System of Simultaneous Equations to Evaluate
Evidence of HMOs' Earnings Management Efforts
(n=723)

Predictor Variables	Expected Sign	Dependent Variable			
		$\Delta IBME_{it}$ (One period change in IBME)		$\delta IBME_{it}$ (Deviation of IBME from Mean of HMO Model Type)	
		Coefficient	T-Ratio	Coefficient	T-Ratio
Intercept	?	0.019	2.40*	0.084	3.15**
<i>Dummy Variables</i>					
$D(1)_{it}$ (For-profit)	?	-0.008	-1.17	0.022	2.68**
$D(2)_{it}$ (Affiliated)	?	-0.005	0.84	0.030	3.05**
$D(3)_{it}$ (IPA/Network)	?	-0.010	-1.25	-0.043	-5.46***
<i>Jointly Endogenous Variables</i>					
$\delta IBME_{it}$	+	0.240	3.48***	-	-
$\Delta IBME_{it}$	+	-	-	0.519	3.32***
<i>Structural Variables</i>					
$IBME'_{it}$	+	-	-	0.046	4.14***
g^2_{ME} (growth, costs)	?	-0.007	-4.33***	-	-
g^2_{MB} (growth, membership)	?	0.001	2.50*	-	-
<i>Earnings Management Indicators</i>					
Profitability Effect:					
ΔRET & RET (γ_1)	+	0.027	3.32***	0.296	10.04***
Size Effect:					
($\Delta SIZE$ & $SIZE$)					
* $DPROFIT$ (γ_{21})	+	-0.034	-1.69#	-0.013	-5.51***
* $DMIXED$ (γ_{22})	-	-0.022	-3.66***	-0.012	-4.68***
* $DLOSS$ (γ_{23})	-	-0.004	-1.70*	-0.007	-2.46**
Minimum net worth effect: (ΔDNW & DNW)					
* $DPROFIT$ (γ_{31})	no effect	0.007	0.31	0.039	1.31
* $DMIXED$ (γ_{32})	+	0.011	4.70***	0.086	5.96***
* $DLOSS$ (γ_{33})	+	0.059	3.58***	0.051	1.68*

(Continued)

Table 5 (Continued)

Federal Insolvency Requirement:				
$\Delta FCR \text{ \& } FCR (\gamma_4)$	+	0.123	2.64**	-0.049
				-0.98
Financial Leverage:				
$\Delta LEVU \text{ \& } LEVU (\gamma_5)$	-	0.011	1.55 #	-0.027
				-3.02**
OLS/2SLS Summary Statistics:				
2SLS Adjusted R-square			0.246	0.310
White's (1980) test for Residual Heteroscedasticity			27.18	23.96
Probability			0.10	0.11
3SLS Summary Statistics:				
System-weighted R-square				0.262
System-weighted mean squared error				0.996

System of simultaneous equations estimated:

$$\begin{aligned} \Delta IBME_{it} = & \alpha_0 + \sum_{I=1}^3 \alpha_{0I} D(I)_{it} + \alpha_2 (\delta IBME_{it}) + \alpha_3 (g_{ME}^2) + \alpha_4 (g_{MB}^2) + \gamma_1 (\Delta RET_{it}) \\ & + \gamma_{21} [\Delta SIZE * DPROFIT]_{it} + \gamma_{22} [\Delta SIZE * DMIXED]_{it} + \gamma_{23} [\Delta SIZE * DLOSS]_{it} \\ & + \gamma_{31} [\Delta DNW * DPROFIT]_{it} + \gamma_{32} [\Delta DNW * DMIXED]_{it} + \gamma_{33} [\Delta DNW * DLOSS]_{it} \\ & + \gamma_4 (\Delta FCR_{it}) + \gamma_5 (\Delta LEV * DU)_{it} + e_{it} \end{aligned}$$

$$\begin{aligned} \delta IBME_{it} = & \alpha_0 + \sum_{I=1}^3 \alpha_{0I} D(I)_{it} + \alpha_2 (\Delta IBME_{it}) + \alpha_3 (IBME'_{it}) + \gamma_1 (RET_{it}) \\ & + \gamma_{21} [SIZE * DPROFIT]_{it} + \gamma_{22} [SIZE * DMIXED]_{it} + \gamma_{23} [SIZE * DLOSS]_{it} \\ & + \gamma_{31} [DNW * DPROFIT]_{it} + \gamma_{32} [DNW * DMIXED]_{it} + \gamma_{33} [DNW * DLOSS]_{it} \\ & + \gamma_4 (FCR_{it}) + \gamma_5 (LEV * DU)_{it} + \varepsilon_{it} \end{aligned}$$

Note: Significance tests for coefficients with expected signs are one-tailed, all others are two-tailed tests.

+Significant at a probability of less than 0.10;

*Significant at a probability of less than 0.05;

**Significant at a probability of less than 0.01;

***Significant at a probability of less than 0.001;

#Significant at a probability of 0.90 (for one-tailed tests, indicates a sign contrary to expectations).

most direct test of the original hypothesis. The sign for γ_{21} was expected to be positive in both equations. Instead, it is consistently negative and statistically significant in both equations, implying an inverse relationship between size (enrollment) and the *IBME* accrual among the HMOs that were consistently profitable over the period.¹⁶

In contrast to the unexpected results for $Ha_{2,1}$, the results for the other two hypotheses relating to size ($Ha_{2,2}$ and $Ha_{2,3}$) are more consistent with expectations. The coefficients for both *SIZE*DMIXED* and *SIZE*DLOSS* have the expected negative sign and are statistically significant in both equations. The results based on the level model (*IBME*) are slightly more consistent with expectations than the change model (Δ *IBME*). However, contrary to the reasoning underlying $Ha_{2,1}$ to $Ha_{2,3}$, the magnitude of the coefficients for *SIZE*DPROFIT*, *SIZE*DMIXED*, and *SIZE*DLOSS* are very close, and a formal F-test of a null hypothesis of equality of the three coefficients (γ_{21} , γ_{22} , and γ_{23}) could not reject the null in either model at an alpha of 0.10.

Overall, it is reasonable to conclude that size is inversely related to the magnitude of the *IBME* accrual, with larger HMOs tending to understate their *IBME*s more than their smaller counterparts. While this result is consistent with the reasoning advanced for unprofitable HMOs, it is inconsistent with the political visibility hypothesis with size as a proxy for political visibility.¹⁷

The results in table 5 are generally consistent with the hypotheses regarding the regulatory effect of the statutory minimum net worth requirements ($Ha_{3,1}$ to $Ha_{3,3}$). As expected, the coefficient γ_{31} (for Δ *DNW*DPROFIT*) is statistically insignificant in both equations. In addition, γ_{32} (for Δ *DNW*DMIXED* and *DNW*DMIXED*) and γ_{33} (for Δ *DNW*DLOSS* and *DNW*DLOSS*) are statistically significant and positively signed (as expected) in both equations. However, F-tests conducted for a null hypothesis of equality of the respective coefficients ($\gamma_{31} = \gamma_{32} = \gamma_{33}$) resulted in a nonrejection of the null in both equations at a probability level of 0.10.

Taken as a whole, the statistical insignificance of γ_{31} and the positive sign for γ_{32} and γ_{33} is consistent with the interpretation that HMO management were influenced (to some degree) in their discretionary estimate of *IBME* by the proximity to the minimum net standards. Specifically, in the two groups most at risk (the *DLOSS* and *DMIXED* subgroups), the margin of safety over the statutory minimum net worth standards is positively related to *IBME*, while no such relationship existed in the group at least risk (the *DPROFIT* or consistently profitable subgroup).

The results for Ha_4 (the federal cash reserve requirement effect) are also ambiguous. Δ *FCR* is statistically significant and positively signed in the change model, but *FCR* is statistically not different from zero in the equation for δ *IBME*. To the extent that change models tend to be more robust to specification error than level models involving omitted

¹⁶ The Spearman rank order correlations in table 4 show a negative and statistically significant relationship between Δ *SIZE*DPROFIT* and Δ *RET* but a positive relationship between the *SIZE*DPROFIT* and *RET*. This implies that while the larger HMOs were generally more profitable, rapid growth in enrollments was inversely related to profitability. This is consistent with a strategy whereby the smaller, fastest-growing HMOs underprice their services in order to gain market share in a highly competitive market. Furthermore, as suggested by a reviewer, the fastest-growing, profitable HMOs may need more capital and may therefore be motivated to inflate earnings, resulting in the negative regression coefficient for Δ *SIZE*DPROFIT* observed.

¹⁷ In addition to the possible explanation advanced in the footnote above for this anomalous result for the *DPROFIT* subgroup, another possibility is the operation of some unidentified variable. One could plausibly argue that large profitable HMOs may have resorted to the understatement of IBNRs because management compensation schemes favored such a course of action. Unfortunately, this possibility could not be explored because of lack of data on management compensation schemes in this industry.

time-invariant variables (Landsman and Magliolo 1988), the result from the change model should perhaps be given greater weight.¹⁸

The results for H_{a_5} (the debt contracting cost hypothesis) for the unaffiliated HMOs are equally ambiguous. The coefficient for $\Delta LEVU$ is statistically significant (at an alpha of 0.9 since the sign is opposite of what was expected). In contrast, the coefficient for $LEVU$ in the level model has the expected sign and is statistically significant (at an alpha of 0.01). These results are difficult to interpret since the underlying statistical theory indicates that if the variable was properly measured, the coefficient should have the same sign in both the level and change models. The conflicting results suggest that the leverage effect may not have been properly measured or that the relationship is more complicated than the linear model used in this study.

To determine the sensitivity of these results, analyses on various subsamples were performed. In the for-profit subsample, the results were essentially identical to those reported in table 5. When the sample was restricted to the nonprofit group, $LEVU$ was significant and negatively signed (as expected) in the equation for $\Delta IBME$. Similarly, the coefficient for FCR was positively signed and statistically significant in the change model, but insignificant in the level model. All other variables were qualitatively similar to those reported in table 5. For the affiliated and unaffiliated subsamples, there were no material differences from the results reported in table 5.

V. Conclusions

Our objective was to determine if some of the determinants of earnings management and accounting policy choice reported in the literature apply to the special field of pre-paid health care. By focusing on a voluntary practice of accruing $IBME$ s that did not become mandatory until 1989, we were able to study earnings management in a regulatory environment where accounting standards were still evolving.

Our findings are consistent with a hypothesis that HMO management behaved strategically in a period of difficulty for the industry. The findings are most consistent with the hypotheses relating to profitability, size, and the margin of safety over the statutory minimum net worth requirements enacted by individual states. The empirical regularities found in this industry provide additional evidence consistent with previous research findings that management appears to have the ability and the incentive to influence the amount of earnings (or losses) reported and that this discretion is exercised to achieve specific managerial objectives. The findings suggest that earnings management may not be confined only to unregulated industries but may also occur in regulated environments despite regulatory oversight (particularly when such oversight is weak).¹⁹

¹⁸ To determine if the statistically insignificant result for the level model was due to a threshold effect incorrectly modeled as a continuous effect, the analysis was repeated using a dummy variable (1 = positive FCR , 0 = negative FCR) in place of FCR . The coefficient for this dummy threshold variable was positive but significant only at an alpha of 0.15. Thus, the threshold effect argument cannot be used to explain this lack of significance.

¹⁹ Results from a new study that examines the effect of premium rate regulation at the state level on HMOs' earnings management efforts offer additional evidence of managerial motivation in the industry. See Mensah et al. (1993).

References

- Abdel-khalik, A., P. R. Regier, and S. A. Reiter. 1989. Some thoughts on empirical research in positive theory. In *The State of Accounting Research as We Enter the 1990s*, edited by Thomas J. Frecka. Champaign, IL: University of Illinois.
- American Institute of Certified Public Accountants. 1985. *Accounting for Health Maintenance Organization and Associated Entities*. Issues paper, Health Maintenance Organization Task Force. New York: AICPA.
- _____. 1990. *Auditing of Providers of Health Care Services*. 2d ed. New York: AICPA.
- American International Healthcare. 1988. *AIH Profile Diskette Version Series 88: User's Manual*. Baltimore: AIH.
- Baber, W. R., P. M. Fairfield, and J. A. Haggard. 1991. The effect of concern about reported income on discretionary spending decisions: The case of research and development. *The Accounting Review* 66 (October): 818-29.
- Berndt, E. R. 1991. *The Practice of Econometrics: Classic and Contemporary*. New York: Addison Wesley.
- Christie, A. A. 1987. On cross-sectional analysis in accounting research. *Journal of Accounting and Economics* 9 (December): 231-58.
- _____. 1990. Aggregation of test statistics: An evaluation of the evidence on contracting and size hypothesis. *Journal of Accounting and Economics* 12 (January): 15-36.
- DeAngelo, L. E. 1986. Accounting numbers as market valuation substitutes: A study of management buyouts of public stockholders. *The Accounting Review* 61 (July): 400-20.
- Gruber, L. R., M. Shadle, and C. L. Polich. 1988. From movement to industry: The growth of HMOs. *Health Affairs* 7 (Summer): 197-208.
- Hansmann, H. B. 1980. The role of nonprofit enterprise. *The Yale Law Journal* 89 (April): 838-901.
- Healy, P. M. 1985. The effect of bonus schemes on accounting choices. *Journal of Accounting and Economics* 7 (April): 85-107.
- Ingram, R. W., and W. A. Robbins. 1987. Accounting guidelines for HMOs: Issues and practices. *Healthcare Financial Management* 41 (March): 51-58.
- Joffe, M. 1985. Working with federal HMO insolvency requirements. *Group Health Journal* 26 (Fall): 7-10.
- Kenkle, P. 1988. HMOs can no longer hazard a guess on cost. *Modern Healthcare* (October 7): 64.
- Landsman, W. R., and J. Magliolo. 1988. Cross-sectional capital market research and model specification. *The Accounting Review* 58 (October): 586-604.
- Langwell, K. M. 1990. Structure and Performance of health maintenance organizations: A review. *Health Care Financing Review* 12 (Fall): 71-79.
- Leisure, L. B. 1988. Managed care plans: The third generation. *Best's Review* 89 (October): 56-58.
- McNichols, M., and G. P. Wilson. 1988. Evidence of earnings management from the provision for bad debts. *Journal of Accounting Research* 26 (Supplement): 1-31.
- Mensah, Y. M., J. M. Considine, and L. Oakes. 1993. Adverse public policy implications of the accounting conservatism doctrine: The case of premium rate regulation in the HMO industry. Working paper, Rutgers University.
- Moyer, S. E. 1990. Capital adequacy ratio regulations and accounting choices in commercial banks. *Journal of Accounting and Economics* 13 (June): 123-54.
- Newhouse, J. P. 1970. Towards a theory of nonprofit institutions: An economic model of a hospital. *American Economic Review* 60 (March): 64-74.
- Pindyck, R. S., and D. L. Rubinfield. 1981. *Econometric Models and Economic Forecasts*. McGraw Hill.
- Robbins, W. A., and R. W. Ingram. 1987. Financial reporting of health maintenance organizations. *The CPA Journal* 57 (January): 14-18.

- Royalty, P. G. 1991. IRS toughens its guidelines on tax exemptions for HMOs. *Healthcare Financial Management* 45 (January): 58-60.
- Schipper, K. 1989. Commentary on earnings management. *Accounting Horizons* 3 (December): 91-102.
- Stone, D. L., and S. Heffernan. 1989. Survey on regulations of HMOs and HMO solvency: Findings and recommendations. *GHAA Journal* 30 (May): 28-39.
- Watts, R. L., and J. L. Zimmerman. 1978. Towards a positive theory of the determination of accounting standards. *The Accounting Review* 53 (January): 112-34.
- _____, and _____. 1990. Positive accounting theory: A ten year perspective. *The Accounting Review* 65 (January): 131-56.
- White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48 (May): 817-38.
- Zellner, A., and H. Theil. 1962. Three-stage least squares: Simultaneous estimation of simultaneous relations. *Econometrica* 30 (January): 54-78.

The Use of Information in Total Cost Management

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SYNOPSIS AND INTRODUCTION: In 1983, Medicare changed its method of reimbursement for hospitals from an all-charges-paid basis to a flat-fee-per-diagnosis basis. Managing the cost of treatment became increasingly important. In an effort to influence physicians to reduce the amount of resources used, hospital controllers began providing cost information about patient treatment to physicians. Several questions were being asked at the time: (1) Although society affirmed that cost containment is necessary, should physicians ethically consider costs in making treatment decisions? (2) Would a group of professionals incorporate a new set of information provided by the accounting system into their decision-making process? (3) What design of management accounting system would best facilitate physician decision making around cost containment? This research examines the effects of providing cost reports, as a new information set, in this complex professional environment which is characterized by implicit contracts.

An economic analysis explores the conditions necessary to align hospital and physician goals around cost management. An appropriate set of accounting information may help detect overtreatment. In addition, the reputation cost of being known as an overtreater may provide the necessary incentive for success in containing costs.

A cross-sectional analysis of hospitals was undertaken to determine the response of physicians to this new information set. Differences in their practice patterns were analyzed in relation to the types of accounting information received. Average charges were used to measure practice patterns. The study population was partitioned according to the types of information provided and frequency of reporting.

The results of the empirical analysis suggest hospitals providing physicians with their own case costs and some comparison information had significantly

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lower average charges, statistically, than those hospitals that did not. The comparison information may be reports of other individual physicians' case costs or on-the-average practice patterns within the hospital or within the state.

This study contributes to current research in several ways. First, a theoretical framework has been developed that links incentives to manage costs with the type of accounting information provided in organizational environments characterized by a reliance upon implicit contracts. Second, from an accounting perspective, disaggregate information gathered by the accounting process and some sort of benchmark are necessary to induce this reputation effect that appears to influence behavior. Third, a linkage between total cost management and the use of accounting benchmark information in an implicit contracting environment is documented.

Key Words: *Agency theory, Reputation, Cost management, Implicit contracts.*

Data Availability: *Data are available from the author upon request.*

THE remainder of this article is organized as follows. Section I provides a literature review and details of the institutional environment. Section II develops an economic analysis of physician utility. In section III the hypotheses are presented. Descriptions of the sample and data are given and empirical tests of the hypotheses are described in sections IV and V. Finally, results are presented and conclusions are drawn in sections VI and VII.

I. Literature Review and Institutional Background

The use of managerial accounting information in an incomplete contracting environment has been overlooked in previous literature (Baiman 1990). The hospital setting is particularly useful for analysis of this issue because much of the contracting environment is implicit. Cost accounting approaches such as the use of benchmarks have not typically been part of this accounting environment in the past. It is also a situation in which controllers are willing to share information, and high quality data bases are available.

Traditionally, hospitals have accumulated aggregate cost information for government regulatory reporting purposes only. Prior to 1983, there was no reason for them to use cost information for any other purpose. When Medicare changed its reimbursement system, however, cost containment became a priority and hospital controllers began considering cost accounting techniques used in other industries (Maurice 1987). They began exploring approaches such as product-line costing, using a standard or protocol case as a benchmark, and providing physicians with cost as a new information set in deciding on medical treatments (Coombs 1987).

Eisenberg (1986, 3) estimates that roughly 80 percent of all medical expenditures are made by physicians in their medical treatment decision-making process. Cooperation between physicians and hospitals is necessary for cost containment efforts to succeed. If most physicians were employed by hospitals, compensation contracts could force cost-containing behavior. However, explicit contracts generally do not exist between hospitals and physicians such that influence must be exerted through some implicit means (Feldman et al.

1981).¹ Since physicians traditionally had not been given cost information, the first step that controllers took in attempting to influence their behavior was to provide them with cost information about their patient treatments. These controllers questioned whether this strategy would work and had little understanding about why it might work since physicians had always operated autonomously in their decision making. In essence, controllers were beginning a process of monitoring and auditing physicians' practices, which carried the risk of being rejected by physicians.

The relationship between hospitals and physicians is not typical of a "traditional" principal and agent setting in which explicit compensation contracts govern behavior.² Harris (1977, 475) describes a hospital as "two firms in one." One part is run by physicians and the other by hospital administrators. The doctor-patient relation renders the physician's medical practice contractually separate from the rest of the hospital. The patient contracts separately for the doctor's services. Separate insurance coverage for hospital care and physician fees is common.

The doctor and hospital are therefore, really part of the same firm. But there is a whole system of institutional constraints designed to make doctors look like individual entrepreneurs who happen to conduct their business on the hospital's premises (Harris 1977, 475).

In part, this separation in contracting is due to the strong professional ethics suggesting that the doctor must be left alone to do whatever is necessary for the patient's well being. Seriously ill patients do not necessarily want doctors to be cost-effective agents. In a hospital setting, because evaluation of a patient's response to treatment is highly subjective, it is often impossible to verify *ex post* that appropriate treatment was ordered. Thus, explicit contracts contingent upon patient benefit from treatment are not useful in this setting.

Therefore, no compensation contracts exist between most hospitals and admitting physicians. Doctors are issued "staff privileges" allowing them to admit patients to the hospital through a rationing system that is governed by a complex set of bylaws and controlled by the medical staff. This process does not address the compensation of admitting physicians in any manner. Access to the hospitals' inputs (X-rays, nursing services, and pharmaceuticals, for example) may not be purchased by the physician. This separation has been upheld by law (Curran 1977).

Incentives between the physician and hospital are aligned when private payers or insurance companies pay full hospital charges for a patient's treatment and physicians are reimbursed on a fee-per-visit basis while the patient remained hospitalized; both profit (as long as charges exceed costs) by keeping the patient hospitalized as long as is deemed necessary (or longer). As agent for the patient, the physician orders services that the hospital sup-

¹Prepaid group practices, HMOs, offer health insurance on a capitation basis, compensate physicians by salary, and often own hospitals. These organizations are an exception to the implicit claims environment. Roughly 19 percent of employer-provided insurance by large- and medium-sized firms in 1988 was for HMO enrollment (Gold and Hodges 1989, 125). This study concentrates on voluntary hospitals, i.e., hospitals that are generally non-profit and are governed by an outside board whose members, in earlier times, were volunteers. Physicians practicing in these hospitals are private practice physicians with the exception of those few hospital-based specialists such as radiologists and emergency room physicians.

²Jensen and Meckling (1976, 310) define organizations as "legal fictions which serve as a nexus for a set of contracting relationships among individuals." Under certain circumstances, explicit contracting is not available or is subject to a political process; therefore, implicit contracts are used instead. Implicit contracts are defined by Rosen (1985, 1149) as "a mutual understanding between worker and employer" and are promises to behave in particular ways where inputs and outcomes are complex or uncertain and therefore difficult to use in determining written contracts.

plies and conflicts arise only at times when the hospital is at full capacity. The incentive for the hospital, then, is to increase capacity and service availability and to leave the physician alone with regard to treatment decisions. Information about hospital operating results and marginal cost of treatment has no value with respect to incentive alignment because goal congruence between the hospital and physician is the rule rather than the exception. Thus, overtreatment with regard to cost has probably been the rule as well.

This environment led to increasing national expenditures for health care, however. The health sector, which in 1950 used only 4.4 percent of the nation's output, had grown to 10.8 percent by 1983 (Fuchs 1986, 334) and to 14 percent by 1992 (New York Times 1/5/93, A1). Cost containment measures failed during this time period. Research indicates that physicians were influenced by cost containment measures that directly affected their fees and billings, but they changed their practice patterns (unbundling services, for example) to maintain or enhance their incomes. (See Hadley 1979; Berry et al. 1980; Rice 1983.)

In an attempt to slow this trend, Congress changed the reimbursement system for hospitalized Medicare patients from a retrospective "cost of treatment" basis to a prospective, flat-fee-per-diagnosis basis in 1983. To determine payment, diagnoses were grouped into 470 categories, or diagnosis-related groups (DRGs). Each group is assigned a weight that represents the national average resource utilization for a typical patient with that particular diagnosis. A base payment is to be calculated using a combination of hospital-specific regional and national rates. The weight of the DRG is multiplied times the base payment amount to determine reimbursement. In addition, adjustments are permitted for the following: (1) outliers: those patients whose costs or length of stay exceed a specified maximum amount, (2) hospitals providing medical education, and (3) hospitals that serve a large number of low-income patients. Supplemental insurance will not alter incentives because the hospital cannot charge the patient more than a small deductible payment upon admission.

Medicare's reimbursement method for physicians, based on a "usual and customary" fee-per-visit that varied across physicians, remained unchanged by the 1983 legislation. Consequently, the goals of the hospital and physician were no longer congruent. Under the new system, the hospital must cover all costs incurred once a patient has been admitted since costs per se are not reimbursed. The hospital is thus motivated to provide the physician additional information to try to bring about incentive alignment. To maintain or expand current capacity, for-profit hospitals want to earn a profit while nonprofit hospitals prefer to have some net operating surplus. These financial goals require that physicians order services for Medicare patients that are, on average, at or below the reimbursement amounts. Short of instituting ownership changes that may decrease the ability of an organization to provide a dynamic, patient-oriented culture, no explicit contracting methods exist that enable the hospital to influence physicians' behavior.

II. Use of Information and Reputation

In this analysis, the physician is modeled as a rational, economic being who considers current and future income as arguments in his or her utility function. Patient benefit also enters the function because of its economic influence on utility. Future income streams rely on a constant flow of patients, which is influenced by patients' perceptions of treatment benefits received. The physician also derives personal satisfaction from knowing that the appropriate treatment was ordered.

Assume the physician's utility function is additively separable in $U[\cdot]$ for: (1) utility for patient benefit, $B(q)$, where patient benefit is a function of quantity of services pro-

vided; (2) his or her own income, $I(q)$, where income is, in part, a function of quantity of services provided; and (3) V_Ω , a disutility for being detected as overtreating a patient. Expected utility can then be represented by:

$$E[H(q, \Omega)] = U[B(q) + I(q) - V_\Omega * (p(\Omega | q, A))], \quad (1)$$

where $E[H(\bullet)]$ is the physician's expected utility function for some level of patient services, q , and some level of being "publicly" considered as overtreating, Ω . For convenience, V_Ω is assumed to be a positive constant that represents the expected cost, in terms of utility, of having a reputation for overtreating patients. This expected cost results from the hospital's ability to create a negative reputation effect among peers for those doctors who are perceived to overtreat. Greene (1991, 30), in an article on economic credentialing, suggests that "[e]xecutives at hospitals that track utilization and cost data believe physicians respond best to suggestions from peers to modify their practices to improve quality and reduce costs."

The probability of the physician's being detected, $p(\Omega | q, A)$, is conditional on the quantity of services prescribed, q , and the amount (disaggregation and frequency of reports) of information about resource usage provided to physicians, A , where $A=0$ denotes that no information is provided and $A>0$ denotes that some information is provided at periodic intervals. Intuitively, the larger the q , given $q>q^*$ (where q^* is the optimal level of patient services provided), the larger the likelihood of being considered as overtreating. Also, the more extensive the information set, the greater the likelihood of being considered as overtreating (if overtreatment exists). The issue of interest here is the effect of A on q . Assuming, for simplicity, that there is no probability of being considered as overtreating given $q<q_p$, then the following relationships hold:

$$p(\Omega | q, A=0) = 0$$

$$dp/dA > 0 \quad \forall q > q^*$$

$$dp/dq > 0 \quad \forall q > q^*, A > 0.$$

Here, the probability of being considered as overtreating is zero, in general, when no information is supplied. Of course, if the patient contracts an illness related to the hospital stay, overtreatment may be detected as well. Extreme cases of undertreatment, overtreatment, and misdiagnosis, causing the patient more harm than benefit, are quite likely to result in malpractice suits. The model does not incorporate these extremes in the interest of simplicity. The current legal environment provides strong incentive for physicians to avoid either extreme, as does a concern about reputation among patients.

Examine the case for no information, $A=0$. The physician's problem is reduced to:

$$\text{Max}_q U[B(q) + I(q)]. \quad (2)$$

This function is maximized for the q whereby the first-order condition is:

$$(\partial U / \partial B)(dB/dq) + (\partial U / \partial I)(dI/dq) = 0. \quad (3)$$

$\partial U / \partial B$ is the change in physician utility as the patient benefits from treatment. If the physician's utility is independent of the patient's benefit, the term will be zero; i.e.,

income is the only consideration. I assume that physicians will want to increase the number of patients to a point. Physicians will, therefore, be concerned about patient benefit as it relates to their own economic position. This assumption implies that the term is positive (i.e., $\partial U/\partial B > 0$). Physician utility is concave in B , which implies that as benefit increases, utility will increase at a diminishing rate (i.e., $\partial^2 U/\partial B^2 < 0$).

The change in patient benefits as number of services change, dB/dq , can be positive, negative, or zero. Therefore, the entire term $(\partial U/\partial B)(dB/dq)$ is positive when a patient is expected to gain from treatment, zero at the optimum level of costless care (the optimum may be different under costly care), and negative when additional treatment results in expectations of decreasing benefit. The optimal amount of services, q^* , provides maximum benefit, B , to the patient. Thus, if $q < q^*$, further benefit could be gained by increasing services; if $q > q^*$, total benefit slowly declines. The time-price of receiving treatment (the cost incurred for being unable to earn income or enjoy leisure) and the increasing risk of infection or other iatrogenic illness (those complications induced by the treatment that may be associated with a continuing hospital stay) increase as treatment and stay increase.

$\partial U/\partial I$ is assumed to be positive. Physician utility is concave in I , which implies that as income increases, utility will increase at a diminishing rate. Therefore, the second derivative is negative. dI/dq is positive for number of patient visits, but zero for other patient services. Since a portion of patient service is length of stay, for simplicity dI/dq is assumed to be an increasing function of services, which include board and room. Therefore, the entire term $(\partial U/\partial I)(dI/dq)$ is positive. This relationship is summarized by the following proposition:

Proposition I: In the absence of accounting information, ($A = 0$), the number of services ordered for the patient, q_0 , is strictly greater than q^* .

Proof: See appendix

The physician has an incentive to increase treatment beyond the optimal level when considering the patient's needs, then. Feldstein (1983, 340) suggests that the total cost of medical care for HMO enrollees, the premium plus any out-of-pocket expenses, is 10 to 40 percent lower than that for persons with comparable fee-for-service insurance coverage, which is consistent with the notion of overtreatment as the norm when no explicit contracts exist between hospitals and physicians.

Next, consider the effect of providing physicians with information of increasing detail about the costs of treatment. For $A > 0$ the physician's problem is:

$$\max_q E[H(q, \Omega)] = U[B(q) + I(q) - V_\Omega * (p(\Omega | q, A))]. \quad (4)$$

To maximize, the first-order condition is:

$$dE(H)/dq = (\partial U/\partial B)(dB/dq) + (\partial U/\partial I)(dI/dq) - V_\Omega (dp/dq) = 0. \quad (5)$$

The effect of A on q (dq/dA) is given by proposition II.

Proposition II: The physician will select a lower level of q and thus reduce the number of services provided when A is increased from zero to some positive level.

Proof: See appendix

Note that under a retrospective, all-charges-paid reimbursement system, hospital profits are increasing in q ; there is no reason to provide information and overtreatment will be the

rule (Proposition I). Under prospective payment, however, profits are decreasing in q . Hospitals, desiring to break even or have a surplus, will want physicians to reduce services ordered; thus they will be motivated to increase A to induce physicians to select a lower level of q (Proposition II). These propositions yield

Corollary I: Under the prospective payment system, hospitals have incentive to provide increasingly detailed and frequent information to physicians regarding treatment.

A physician's reputation for overtreatment among other physicians will differ from reputation among patients. Overtreatment may not be perceived as "bad" from a patient's perspective unless it precipitates an illness. Physicians, however, may recognize when those patients undergo an unnecessarily long hospital stay or excessive tests and procedures. Although this is a theoretical discussion of reputation, apparently physicians are aware of others' practice patterns (Greene 1991).

In a broader context, Baiman (1990, 356) suggests that "[a]llowing for jointly observable but unverifiable information and incorporating incomplete contracts in a multiperiod setting allows concerns for trust and fairness and more generally reputation to endogenously arise." In this situation, the accounting system produces jointly observable information, but patient outcomes are not verifiable and the contracting environment is incomplete, so reputation arises as a potential disciplining mechanism. Physicians are informed about the costs of resources ordered and are given set of comparison costs, such as those of other physicians in the hospital or state, which informs them where they stand relative to others.

III. Hypotheses Development

Some hospitals might not be concerned with containing costs if, for example, they are subsidized in some manner. This type of institution may not provide physicians any information about resource usage or the financial situation of the hospital. Other hospitals provide monthly, quarterly, and/or annual financial information about each case and the department or hospital as a whole. Some provide actual or estimated cumulative costs or charges in the patient's medical chart on a daily basis, and others provide frequent information about a physician's own cases plus a set of information with which a comparison can be made, such as a hospitalwide or statewide average. The effects of providing information in a more timely and disaggregate manner need to be determined so that controllers will better understand what type of management accounting system is useful in cost containment.

The following hypotheses test whether professionals will respond to cost information as an incremental set in their decision making and act as a control for further tests incorporating a reputation effect.

- H1a. Across hospitals, patient services ordered by physicians differ as the information regarding resource utilization and hospital operations is reported differently. Specifically, the quantity of average services per hospital has a lower mean when hospitals report cost information more frequently.
- H1b. The variance of average services ordered is smaller in those hospitals reporting cost information more frequently.

These hypotheses consider only the effect of information. From an economic viewpoint, physicians have little incentive to respond to information about cost of treatment only. However, when a reputation effect is induced, bringing about potential economic and personal consequences for being perceived as an overtreater, fewer resources should be used. A physician who perceives himself or herself to be below the average may increase services ordered. Therefore, variance may be smaller, even if no difference in the mean is detected.

H2a. Those hospitals reporting a set of information to physicians that provides a basis of comparison for their practice patterns, along with cost and financial information, deliver a lower mean level of services, on average, to patients.

H2b. The variance of average services delivered is smaller for those hospitals providing comparison information than for those that do not provide any.

Controllers appear to induce a reputation effect by providing two sets of information: a profile of each physician's individual patient treatment costs, and some average measure of cost with which the physician can compare. They believe that physicians will use fewer resources and hospital average charges will be lower.

IV. Sample and Data

Hospital cost-tracking systems provide information for federal or state cost reports, which accumulate total institutional costs. Hospital charges, on the other hand, are tracked for billing purposes. Charges are an appropriate surrogate for costs only when state regulation forces them to be closely aligned. Data available from hospitals in the state of Washington were particularly useful because of the following specific state regulations:

- 1) Until 1989, the Washington State Hospital Commission required hospitals to charge no more than 105 percent of costs to patients. If a hospital was found to have a surplus above this amount in a particular year, a rate reduction in charges was enforced.
- 2) Costs within a department could not be shifted to other departments by more than five percent.
- 3) Washington State has no cap on malpractice liability awards; therefore, physicians must balance any reduction in resource usage with the potential threat of suit. Results from this state may be generalizable to states with and without caps.

Other factors also made this state attractive as a study population.³

Table 1, panel A documents the sample reduction process. HMOs and government hospitals were excluded to ensure that the relationship between hospitals and private physicians would be governed by implicit rather than explicit contracts. Panel B presents the ownership structure of the sample. A total of 87 hospitals constituted the sample for 1987 and 1988. This number was reduced to 76 for 1986 because of limitations in the method of data access. Table 2

³ The Washington chapter of the Healthcare Financial Management Association promotes information sharing among health care organizations. Chief financial officers are usually willing to explain the practices and policies within their respective institutions. The state has also maintained a very high quality data base of hospital information.

Table 1
Sample Identification and Ownership Structure

Panel A. Hospital sample reduction process

Total hospitals in Washington State (1986 - 1988)	121
Less:	
Government hospitals:	
Military and state psychiatric centers	10
Others not included:	
Children's hospitals	3
Osteopathic hospitals	2
Group health hospitals	2
Psychiatric hospitals	2
Substance abuse treatment centers	3
Hospitals no longer operating	5
Merged ownership	6
Nonrespondent	1
Final Sample	87

Panel B. Ownership structure

	<i>Number</i>	<i>Percent of sample</i>
Hospital district hospitals*	37	43%
Nonprofit (Other than church-owned)	28	32%
Church-owned	14	16%
For-profit	6	7%
State-owned	1	1%
County-owned	1	1%
Totals	87	100%

*Governed by a board of publicly elected officers and able to levy taxes for operating funds— see exhibit 1 for further description.

Table 2
Descriptive Statistics for Sample Hospitals (Control Variables)

	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Median</i>
Case mix - all payers				
1986	.58	1.54	.94	.91
1987	.62	1.61	.98	.93
1988	.56	2.29	.98	.93
Percent Medicare revenue to total revenue				
1986	3%	81%	46%	46%
1987	15%	81%	46%	46%
1988	3%	79%	46%	46%
Total patient days				
1986	345	157,794	27,676	10,549
1987	275	154,341	26,271	9,672
1988	338	167,618	27,510	10,896
Number of beds				
1986	11	631	122	58
1987	13	628	122	72
1988	13	631	122	87
Occupancy rate				
1986	5%	85%	54%	50%
1987	4%	88%	44%	44%
1988	7%	85%	45%	49%
Average number of doctors providing 80% of admissions				
1986	1	600	48	14
1987	1	600	46	14
1988	1	600	46	14

further describes these hospitals by presenting statistics about control variables such as size and number of patient days.

The Washington State Commission Hospital Abstract Reporting System (CHARS) data base provided most of the dependent and control variable measures. The state hospital commission initiated data collection in mid-1984. However, hospital data were not of uniform quality until 1986; therefore, the years 1986, 1987, and 1988 were selected for study. In 1989, the state deregulated its hospital industry, so that year and those following were excluded. Virginia Mason Hospital was the access source to the CHARS data base. The American Hospital Associations's *Health Care Guide*, the Washington State Hospital *Institutional Membership Directory*, and *The Directory of Residency Training Programs* provided additional data. To collect information for the independent variables, a questionnaire was sent to each hospital with follow-up telephone calls or personal visits when needed.

Several different methods were used to control confounding factors in this study. The first level of control involved selecting particular categories of patients, by DRG, in an effort to reduce influences such as specialty differences, technological change, or local practice pattern differences and yet retain generalizable results. The criteria used as guidelines in the selection process of these diagnostically related groupings are as follows:

- 1) No changes in coding or reimbursement amount by Medicare over the time period.
- 2) No procedural changes in technology that might reduce or increase costs or length of stay during this period.
- 3) DRGs that are least affected by local or regional practice patterns or utilization.
- 4) High-volume DRGs to provide a larger sample and increase generalizability.
- 5) A group of varied DRGs that represent as many different illnesses and diagnoses as possible.
- 6) DRGs that have been clearly defined to minimize coding errors, that is, all patients within the particular DRG have similar diagnoses and are not routinely misclassified because the definition of that DRG is ambiguous.
- 7) DRGs that are treated by physicians who are generalists rather than specialists.

Table 3 describes the six DRGs selected for this study.

V. Empirical Method

Because other factors affect treatment decisions, the following regression model with control variables was used for testing the hypotheses:

$$\begin{aligned} \text{AVCH} = & \alpha + \beta_1 \text{INFO} + \beta_2 \text{TCH} + \beta_3 \text{RUR} + \beta_4 \text{MET} + \beta_5 \text{CMI} + \beta_6 \% \text{MCR} + \beta_7 \text{OCC} \\ & + \beta_8 \text{HD} + \beta_9 \text{PR} + \beta_{10} \text{DOC} + \beta_{11} \text{BED} + \beta_{12} \text{CS} + \beta_{13} \text{DRG127} + \beta_{14} \text{DRG138} \\ & + \beta_{15} \text{DRG140} + \beta_{16} \text{DRG182} + \beta_{17} \text{DRG320} + e. \end{aligned} \quad (6)$$

This cross-sectional examination of hospitals uses average charges, the dependent variables, as a proxy for practice patterns. Average charges (AVCH) were calculated by summing the charges for all Medicare patients of particular DRG and then dividing by the number of patients treated over the course of a year. For example, in 1988, Virginia Mason Hospital had an average total charge of \$5,674 for the 71 cases treated under DRG 89. The independent variables are defined next and then the control variables are described.

Table 3
Mean Average Charge per Year by DRG for the Entire Sample

<i>DRG & Description</i>	<i>Mean Average Charge</i>		
	1986	1987	1988
DRG 89: Simple pneumonia, pleurisy	\$3,854	\$4,291	\$4,780
DRG 127: Heart failure, shock	\$3,317	\$3,542	\$3,938
DRG 138: Cardiac arrhythmia, conduction disorders	\$2,700	\$2,672	\$3,495
DRG 140: Angina pectoris	\$2,218	\$2,290	\$2,482
DRG 182: Esophagitis, gastroenteritis	\$2,262	\$2,565	\$3,076
DRG 320: Kidney and urinary tract infection\$3,014	\$3,072	\$3,576	

The independent variables (INFO), binary variables representing information type and frequency, were coded using the questionnaire. Each binary variable divided the sample hospitals into two groups, one that provided more information and one that provided less. The partitioning was based on responses from hospitals to the questionnaire.⁴ Analysis indicated that hospitals were providing a wide range of information to physicians. For example, one institution provided physicians' costs or charges on individual patients on a daily basis and, during the same time period, provided information about other physicians' practice patterns annually. A scheme was developed to categorize institutions on two dimensions:

- 1) the frequency with which physicians received information about their own utilization, and
- 2) whether comparison information was given.

Inducing a reputation effect (the incentive to respond) required that some sort of comparison information be available. Here, comparison information refers to a wide range, from aggregate (such as average results for all physicians across the state by DRG) to detailed (that is, other physicians' individual case charges or costs within the same hospital). The cat-

⁴ Several other coding algorithms were tested, including one based on factor analysis. These schemes were not able to capture the difference between information and the incentive provided by adding incremental information of a specific nature.

egorizations reflect the fact that hospitals provided comparison information only annually or semi-annually. Information about physicians' individual resource utilization was a necessary prerequisite for the provision of comparison information. No comparison can be made without both pieces, so these groups overlapped.

The sample was partitioned six different times into two groups to capture the two dimensions: frequency and comparison. A description of each partition follows.

- 1) **ANN (Annual):** One group (dummy 1) provided individual physicians information about resource consumption, costs or charges on individual patients at least annually. The other group (dummy 0) provided no cost or charge information on a regular basis.
- 2) **MON (Monthly):** One group (dummy 1) provided cost or charge information at least monthly. The other group (dummy 0) provided either no information or information less frequently than monthly.
- 3) **DIS (Discharge):** One group (dummy 1) provided cost or charge information at discharge or daily. The other group (dummy 0) provided such information less frequently or not at all.
- 4) **COMP (Comparison):** In one group (dummy 1) physicians were given their own individual practice patterns as well as some average or individual case information for comparison purposes at least annually. The other group (dummy 0) provided no comparison information but may have provided some level of patient information without comparison or no information at all.
- 5) **CMON (Comparison-monthly):** Group one (dummy 1) physicians were provided information on their own cases at least monthly. Comparison information was issued at least annually. The other group provided such information less frequently or not at all.
- 6) **CDIS (Comparison-discharge):** One group (dummy 1) provided individual physicians information at discharge or daily and comparison information at least annually. The other group (dummy 0) provided such information less frequently or not at all.

The first three partitions were based on frequency of reporting costs of individual cases and were increasingly smaller subsets representing increasingly frequent reporting patterns. These partitions were used to test hypotheses 1a and 1b. The last three partitions divided hospitals into subsets that provided comparison information in addition to increasingly frequent reports of physician case costs. They were used to test hypotheses 2a and 2b. Figures 1, 2, and 3 illustrate these partitions and also show that the number of hospitals providing information increased across time.

Other factors affecting charges required experimental control. If funding is available through other sources or if Medicare patients are only a small part of total revenues, no incentive exists to contain costs. Therefore, controlling for ownership structure and percentage of Medicare revenue is necessary. Charges will also be affected by whether a hospital is in a rural or metro location, has a teaching program, or has a complex patient mix. Another confounding factor is the size of the hospital or size of the medical staff. Small hospitals may not wish to alienate physicians in any manner, since they rely on admissions from a very few doctors. Those physicians, however, may understand more readily how their decisions affect the bottom line; moreover, they may have no other hospitals in which to practice

Figure 1
Hospital Cost Reporting Environment: Total Sample of Hospitals Across Years

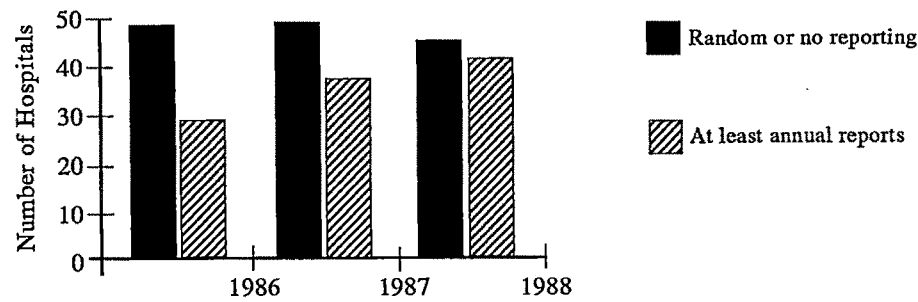
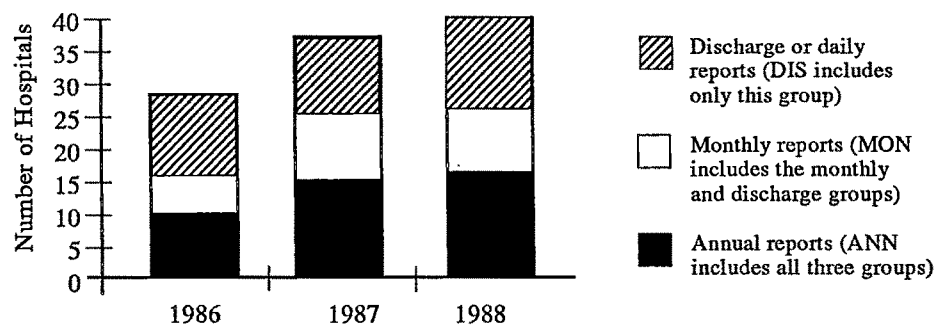
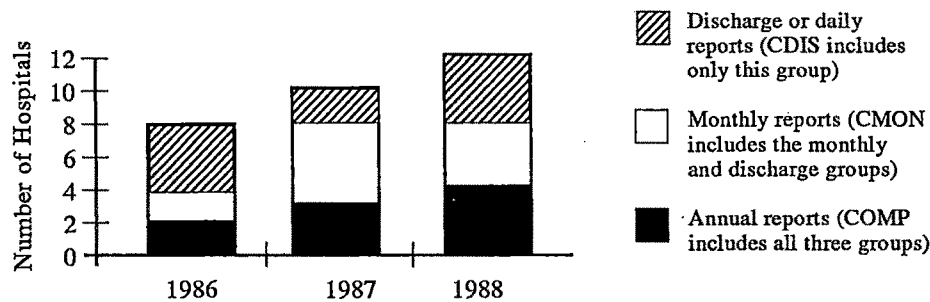


Figure 2
All Hospitals Reporting Cost Information, Including Those Reporting Comparison Information



Note: This sample is the partition of those hospitals reporting at least annually as shown in figure 1.

Figure 3
Hospitals Reporting Comparison Information Annually (Annual Averages, Usually) and Case Cost Information



Note: This group is a subset of those hospitals shown in figure 2.

and so have a vested interest. Physicians in large hospitals may feel like atomistic players whose decisions have very little impact.

Therefore, the following control variables were used: **TCH**, a teaching/nonteaching program binary variable; **RUR**, a binary variable coded one for hospitals located in very small towns; **MET**, a binary variable representing hospitals located in the four largest cities; **CMI** (case mix index), a surrogate for average level of severity of illness per hospital; **%MCR**, percentage of total revenue from Medicare; **OCC**, the occupancy rate; **HD**, a binary variable representing hospital district hospital (a form of ownership); **PR**, a binary variable representing ownership structure as profit making; **DOC**, the size of medical staff; **BED**, the number of hospital beds (a surrogate for size); **CS**, cases, the number of cases per DRG average; **DRG_i**, a dummy variable representing one of five DRGs with the intercept reflecting DRG89. Exhibit 1 contains a complete description of these variables, their calculation, and predictions for the coefficient signs. Table 2 presents mean and median values of these controls.

Exhibit 1

Control Variables: Descriptions, Predictions, and Results

1. **Teaching/nonteaching (TCH):** Institutions with teaching programs tend to be larger and located in urban areas, therefore attracting more difficult and complex cases. Used in Lawrence (1990), Freiman et al. (1989), and Gordon et al. (1991). As predicted, coefficients were consistently positive ($p < 0.001$).
2. **Rural (RUR):** Hospitals located in rural locations are small with limited technological equipment and send complex cases to larger, urban hospitals. Towns with fewer than 6,600 people were considered rural areas. Rural and metro controls are used in Hadley et al. (1989) and Freiman et al. (1989). As predicted, coefficients for the metro binary variables were negative and significant ($p < 0.01$).
3. **Metro (MET):** Populations of 80,000 and greater seemed to be a natural breaking point for determining metro locations. Large city hospitals tend to have more sophisticated technology, greater ability to reduce length of stay, but higher ancillary charges. As predicted, all coefficients were positive and significant ($p < 0.0001$).
4. **Case mix index (CMI):** The Medicare case mix index is measured by adding the total DRG weights for all patients over a year's period and dividing by the number of cases. CMI is an indicator of the difference between a hospital's average cost per case and a national average. Hospitals with higher overall case mix may use resources more intensively since they act as a magnet for more complex cases in general. Used in Lawrence (1990). As predicted, all coefficients on case mix index were positive and significant ($p < 0.01$).
5. **Percent of revenue that is paid by Medicare (%MCR):** Calculated by dividing total Medicare revenue by total hospital revenue for the year. The impact of the physicians' treatment decisions will be greater on hospital profit margins as more revenue is paid prospectively and the opportunity for cost shifting decreases. A negative relation was predicted and found in all regressions ($p < 0.001$).
6. **Occupancy rate (OCC):** Calculated by dividing the number of total patient days for each hospital by number of beds times 365 (the number of bed-days available for one year). Those hospitals with low occupancy rates want to keep patients as long as possible, within limits. Physicians may prefer to move patients out of the

hospital quickly when operations are near capacity. Although no prediction was made, a significant ($p < 0.01$) and positive relation was consistently obtained in 1986 and 1988.

7. **Hospital Districts (HD):** Hospitals organized by hospital districts, often rural, may have a different charge structure than other hospitals. A hospital district is a municipal body of elected officials with the power to tax local citizens. The hospital district commissioners can levy taxes up to a given level to support operations within the hospital without voter approval, so operations may be subsidized, which would lower charges. As predicted, a significant ($p < 0.01$) and negative relation resulted.
8. **Profit or nonprofit status (PR):** Profit status has been found to significantly affect costs (Soderstrom 1991; Lawrence 1990). Profit-oriented hospitals are motivated to keep costs and length of stay low, in order to increase profits. However, they are not subsidized in any manner and therefore tend to have higher charges. Although no prediction was made, average charges were significant ($p < 0.001$) and positively associated with for-profit hospitals.
9. **Size of medical staff (DOC):** This numerical variable does not necessarily enter the regression in a linear fashion. In addition, there may be an interactive effect between **INFO** and **DOC**. Each additional physician (up to a certain number) will, in a diminishing fashion, reduce the impact of individual treatment decisions on total institutional outcomes. A positive relation was predicted, but average charges showed no significant relationship to number of doctors in any of the years. This variable was an estimate by controllers of the number of physicians providing 80 percent of the hospital's business. Since it was subject to considerable measurement error, the true relationship was probably not captured and so no interaction effects were tested.
10. **Beds (BED):** Size was proxied using the number of beds per hospital. Economies of scale suggest that as the hospital becomes larger, charges are lower. However, past findings have shown a positive relationship between costs and beds (Robinson and Luft 1985; Thorpe 1988). A positive prediction was made. The coefficients on beds were negative and highly significant ($p < 0.0001$).
11. **Cases (CS):** Number of cases was the only control variable specific to both the hospital and the DRG. Number of cases may also be a proxy for size, and economies of scale may be evident. A hospital with a specialty in that DRG, however, attracts complex cases resulting in both higher charges and variance. Because calculations of averages are based on number of cases, variance is expected to decrease as cases increase. No prediction was made for this variable. Cases per average DRG observation were strongly significant ($p < 0.0001$) and positive.
12. **Dummy variables for the DRGs (DRG_i):** Binary variables for each of the five DRGs, 127, 138, 140, 182, and 320. The sixth DRG, 89, is reflected by the intercept term. The signs and significance of the coefficients on these dummies merely reflected how they compared to the left out DRG. No inferences can be drawn from this information except in relation to the reference category.

Variables similar to these are routinely used in health-care research. Some types of control were not used, such as whether the hospital had an educational program for physicians about cost control, which nearly all hospitals in the pilot study reported doing. Nor was the sophistication of the information system controlled for because some small hos-

pitals used estimates that provided a reasonable surrogate for costs or charges that might be available in a more timely manner with a highly sophisticated system. Lawrence (1990) found no relationship between total operating cost per case in hospitals and sophistication of accounting systems. Finally, hospitals and doctors may try to differentiate themselves in the market by signaling quality through undertaking risky treatment projects. Because this strategy would bias against finding lower charges and would be difficult to capture, no control was deemed necessary.

In summary, each hospital had approximately six observations per year. Each observation included: a dependent variable, average actual charges for all those patients within one of six DRG groupings; an independent variable, reflecting the hospital's information environment; and the associated hospital-related control variables. Some of the smaller hospitals had fewer than six observations because no patients were treated in those particular DRGs that year.

Estimating the Regression Model

The CHARS data were available with outliers, as defined by Medicare, included or excluded. The sample included outliers to increase the amount of information used in empirical tests.⁵ The numerical variables were tested for normality. A log transformation improved the fit of the dependent variables (see Noreen and Soderstrom 1993). The DRGs were pooled to increase sample size and mitigate the effects of multicollinearity. Pearson correlation coefficients are given in table 4.⁶

Plots of the residuals showed the data to be definitely heteroskedastic in nature; therefore, corrective measures were taken.⁷ A weighted least squares (WLS) method was used to mitigate the heteroskedasticity created by the relationship between variance and number of cases per DRG. Weights in the WLS regressions were the predicted residuals from a regression run with residuals from the original equation as dependent variables and number of cases per DRG as independent variables. From an examination of residual plots, a few observations (four or five per regression) were determined to be outliers with potential to affect the coefficients and were removed. A pooling of data across years was run, but results are not reported here because of a problem due to serial correlation which reduces the variance and increases R^2 .⁸

⁵ By the time a patient has become an outlier, charges are so much greater than reimbursement that the additional payment cannot begin to cover total costs. Containing costs becomes even more important in these cases. The determination that a patient is an outlier is arbitrarily set by Medicare, so including these cases increases sample size in an appropriate manner.

⁶ Several of these values were large enough to indicate potential multicollinearity, so variance inflation factors were analyzed to determine the magnitude of the effects; however, no variance inflation factors were greater than ten. In addition, those variables with correlation coefficients greater than 0.70 were dropped from the regressions in an incremental fashion to determine if coefficients or significance levels would change. Slight differences were noticed; however, the P-values remained unchanged so all of these variables were included.

⁷ Variance in charges was related to size of hospital causing the error terms to be heteroskedastic. In addition, as the number of observations used to calculate an average increases, the variance of the averages decreases, so variance was also a mechanical function of size. Contemporaneous correlation among errors terms, or cross-sectional dependency, is another potential problem with this data. The regressions were run with dummy variables for each hospital to determine the magnitude of this potential problem. The coefficients on these dummies appeared to be only randomly significant and had little effect on the other coefficients or p-values.

⁸ The results were generally consistent with the unpooled data; however, they are not reported because of potential auto correlation. Because there are multiple observations per hospital for each year, the time-series nature of the pooled sample is not explicit; therefore, determining the portion of the current disturbance that is affected by the preceding disturbance (the ρ parameter) is problematic.

Table 4
Pearson Correlation Coefficients
Control Variables—All Years Pooled

	HD	PR	TCH	RUR	MET	MCR	OCC	DOC	BED	CMI
PR	-0.23									
TCH	-0.21	-0.10								
RUR	0.50	-0.22	-0.027							
MET	-0.45	0.20	0.54	-0.43						
MCR	-0.01	0.13	-0.21	0.15	-0.11					
OCC	-0.24	0.19	0.24	-0.38	0.22	-0.19				
DOC	-0.51	0.06	0.52	-0.76*	0.52	-0.21	0.47			
BED	-0.48	-0.03	0.75*	-0.57	0.64	-0.21	0.32	0.79*		
CMI	-0.43	0.10	0.48	-0.43	0.54	0.25	0.22	0.51	0.54	
CS	-0.32	0.01	0.30	-0.44	0.29	-0.02	0.26	0.54	0.57	0.28

*Indicates a correlation coefficient of greater than 0.70

Tests of Variance

To test whether the variance of physicians' practice patterns was smaller when information increased, differences were calculated by subtracting the mean squared errors (MSE) from regressions run on the more-information groups from those run on the less-information groups. A Wilcoxon signed ranks test was performed on these differences. In a second test, ratios of the mean squared errors were calculated using a method similar to Beaver's (1968) U ratio, by dividing the regression MSE from the less-information group by that of the more-information group. The expected value of the numerator divided by the expected value of the denominator is 1. The magnitude of the difference between the variances as the frequency of information reporting increases or comparison information is added can be more easily examined with this ratio.

These regressions were run on individual years as well as on the pooled years sample. Some of the partitions in separate years had small sample sizes so the regressions were not full rank; therefore, the pooled years results are presented. Individual year regression results were very similar to the pooled years findings. Dummy variables were added to the regressions on pooled data for years 1987 and 1988, and average charges were adjusted for inflation using 1987 as a base year.

VI. Results

Hypothesis 1a

Insignificant coefficients were obtained on the independent variables representing hospitals that provided individual physicians information on an annual, monthly, at discharge or daily basis (ANN, MON, and DIS). These results indicate that hospitals reporting physician case cost information had charges that appeared to be no different from hospitals reporting no cost information. Those institutions reporting case costs more frequently had charges that appeared to be no different from those reporting less frequently. Frequency of reporting had no apparent effect. Table 5 lists the coefficients and associated t-scores; table 6 describes the frequency of observations within each partition. These results do not support hypothesis 1a.

Hypothesis 1b

A Wilcoxon signed ranks test was performed on differences between the variances of the more-information and less-information groups. The one-tailed probability z score was 4.48 ($p < 0.001$) for average charges. The variance of the group with more information was significantly less than the variance for the group with less information for all six dependent variables (table 7). This provides support for hypothesis 1b.

Hypothesis 2a

Significantly negative coefficients ($p < 0.01$) were obtained on the coefficients for the dummy variables representing those hospitals providing comparison information at least annually and the physician's own costs or charges at least annually, COMP, or at discharge or daily, CDIS. See table 5. The coefficients for CMON were significantly negative in 1986, and insignificant in 1987 and 1988. These results provide support for hypothesis 2a. Hospitals that provided comparison information had lower average charges than those that did not. Other regressions were run with similar results.⁹

⁹ In regressions using average ancillary charges (all charges except board and room) as dependent variables, similar results were obtained. When length of stay was used as a dependent variable, only random significance obtained.

Table 5
Dependent Variable Results from Weighted Least Squares Regressions
Coefficients and T-Tests from Six Separate Regressions

<i>Information Environment Variables</i>	<i>1986 n = 428</i>	<i>1987 n = 496</i>	<i>1988 n = 557†</i>
ANN			
Case cost information reported at least annually	0.0012 (0.054)	0.0247 (1.204)	-0.0033 (-0.170)
MON			
Case cost information reported at least monthly	-0.0154 (-0.578)	0.0400 (1.673)*	0.0168 (0.727)
DIS			
Case cost information reported at discharge or daily	0.0188 (0.665)	0.0287 (1.081)	0.0192 (0.746)
COMP			
Case cost and comparison information reported at least annually	-0.1026 (-3.028)***	-0.0569 (-2.001)**	-0.0935 (-3.411)***
CMON			
Comparison information reported at least annually, case costs at least monthly	-0.1356 (-3.186)***	0.0069 (0.201)	-0.0389 (-1.176)
CDIS			
Comparison information reported at least annually, case costs at discharge or daily	-0.0997 (-2.194)**	-0.1417 (-2.647)***	-0.1253 (-2.791)***

†In 1988, DRG 183 met the volume criterion. It is identical to DRG 182 but includes older patients with more complex cases.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Range of R^2 : 0.49 to 0.68

Hypothesis 2b

The Wilcoxon signed ranks test showed that hospitals providing more information, including comparison information, had significantly smaller variance (table 7). In the mean squared error ratio test, all ratios were greater than one, indicating that in all six cases, the regression variance of the more-information group was less than the regression variance of the less-information group. When these six ratios were ranked from largest (1) to smallest (6), the largest two ratios represented categories in which hospitals provided comparison information: the largest ratio at 1.42 was that of **COMP** compared to **ANN**, the smallest ratio at 1.07. Both of these groups provided information at least annually; the only difference was that **COMP** hospitals also provided comparison information. See table 8. While this is an ad hoc test, it provides support for hypothesis 2b. The difference in variance

Apparently a reduction in the use of ancillary services drives the overall reduction in total average charges.

Table 6
Frequency of Observations within Information Dummy Variable Partitions

<i>Information Environment Variables</i>	<i>1986 n = 428</i>	<i>1987 n = 496</i>	<i>1988 n = 557</i>
ANN			
Number dummy = 0	284 (66%)	282 (57%)	298 (53%)
Number dummy = 1	144 (34%)	214 (43%)	259 (47%)
MON			
Number dummy = 0	334 (78%)	369 (74%)	411 (74%)
Number dummy = 1	94 (22%)	127 (26%)	146 (26%)
DIS			
Number dummy = 0	365 (85%)	426 (86%)	465 (84%)
Number dummy = 1	63 (15%)	70 (14%)	92 (16%)
COMP			
Number dummy = 0	388 (90%)	431 (87%)	479 (86%)
Number dummy = 1	40 (10%)	65 (13%)	78 (14%)
CMON			
Number dummy = 0	400 (93%)	449 (90%)	505 (91%)
Number dummy = 1	28 (7%)	47 (10%)	52 (9%)
CDIS			
Number dummy = 0	406 (95%)	479 (97%)	533 (96%)
Number dummy = 1	22 (5%)	17 (3%)	24 (4%)

between hospitals providing comparison information and those that did not was larger than the difference in variance between those providing cost information and those that did not.

Control Variables

The coefficients on the control variables were significant with the exception of those for **DOC**, which were insignificant, and those for **BED**, which were not in the direction predicted. Exhibit 1 presents the predicted and actual results for each coefficient.

Summary

There were no significant differences in average charges between hospitals that provided doctors cost or charge information about their own patients. None of the coefficients on **ANN**, **MON**, or **DIS**, variables that represent increasingly frequent reporting periods, were negatively significant, indicating that frequency of reporting had no apparent effect. Although the coefficient on **MON** was significantly positive for 1987, its significance was marginal at best and was not necessarily indicative of any specific relationship. Hypothesis 1a was not supported.

Table 7
Mean Squared Error Differences—Wilcoxon Signed Ranks Test

<i>Variable</i>	<i>MSE</i>	<i>Difference</i>	<i>Rank</i>
ANN	0.0706	-0.005	1
No ANN	0.0756		
MON	0.066	-0.0092	2
No MON	0.0752		
CDIS	0.0596	-0.0139	3
No CDIS	0.0735		
DIS	0.0588	-0.0166	4
No DIS	0.0754		
CMON	0.0532	-0.02041	5
No CMON	0.0736		
COMP	0.0521	-0.0219	6
No COMP	0.0740		

Sum of positive ranks = 0
Sum of negative ranks = 21
Z-score = 4.48, $p < 0.001$

Note: Regression MSE from sample partition with more information is subtracted from MSE of regression using less-information partition. Pooled years are adjusted for inflation with 1987 as base year. $N = 1,237$ in total.

Those hospitals providing comparison information in addition to individual physicians' case charges or costs had lower average charges. The coefficients on **COMP** and **CDIS** were negatively significant in all three years. In 1986, the coefficient on **CMON** was significantly negative, but it was insignificant in 1987 and 1988. The number of observations from hospitals that provided cost or charge information monthly, with comparison information at least annually, increased rapidly in size (68 percent) between 1986 and 1987. In 1986, six hospitals provided this type of information. In 1987, three other hospitals began the practice. More variance may have been introduced. In 1988, one hospital stopped providing monthly information and another began. In 1988, the coefficient was negative, although not significantly so. Frequency of reporting does not seem to have an effect here, although because the sample changed over time, it may be difficult to disentangle the frequency component. Apparently the addition of comparison information was the important factor. Hypothesis 2a was supported.

Variance test results supported both hypotheses 1b and 2b. Hospitals providing more cost information appeared to have lower variance in charges. Hospitals providing comparison information appeared to have even lower variance in charges than those providing cost information alone.

Table 8
U Ratio—Mean Squared Error Ratios

<i>Variable</i>	<i>MSE Ratio</i>
ANN	1.07
Own costs annually	(6)
MON	1.14
Own costs monthly	(5)
DIS	1.28
Own costs at discharge	(3)
COMP	1.42
Comparison—annually	(1)
Own costs annually	
CMON	1.38
Comparison—annually	(2)
Own costs monthly	
CDIS	1.23
Comparison—annually	(4)
Own costs at discharge	

Note: Regression MSE from sample partition with less information divided by MSE from regression using more information partition. Relative rank out of 6 in parentheses, largest=1. The greater than 1, the more the difference between mean square errors. Pooled years adjusted for inflation with 1987 as base year. N = 1,237 in total.

The insignificant coefficients on **DOC** are probably a reflection of measurement error in the variable rather than the true relationship. This variable was estimated by individuals in hospital finance departments and lacks accuracy. The negative relation between bed size and charges is not a typical finding in health-care research. Menke (1990) found diseconomies of scale and a positive relationship between costs per case and bed size. Robinson and Luft (1985) and Thorpe (1988) reported similar findings. However, using both the number of cases per DRG average and the bed size appears to have partially disentangled the economy of scale and specialization effects. As the number of beds increases, there are indeed some economies of scale, especially for fixed costs. Yet, as hospitals grow larger, they tend to invest in higher technologies and to attract specialists and their more complex cases requiring specialized—and often expensive—services.

VII. Conclusions

This research makes several important contributions. First, a theoretical framework is developed that provides a linkage between incentives to contain costs and the type of accounting information provided. Second, the empirical results support this linkage be-

tween physician behavior and the reporting of cost accounting information. Apparently, disaggregate information and some sort of benchmark is necessary (not sufficient) to detect overtreatment. Third, a linkage between total cost management and the use of a benchmark in an implicit contracting environment has been documented. Controllers may want to design cost accounting systems that accumulate and report costs as they arise, provide relatively timely feedback to physicians and incorporate some basis of comparison in the reporting format. These findings may also provide a strategy for other types of organizations, for-profit and nonprofit, in reducing overall costs.

Limitations

There may be other factors common to the hospitals providing comparison information which could drive or contaminate the results.¹⁰ Some measurement error may have been induced because charges were used as a surrogate for costs. The use of a questionnaire can create problems in interpretation of both questions and responses.

A finding of lower mean average charges could indicate an unbundling of services rather than a reduction in usage. Menke (1990) found that among 35 DRGs in hospitals in four states during the period 1983 to 1986, services shifted from an inpatient to an outpatient basis in response to the new reimbursement system, although not on a one-for-one dollar basis.

Future Research Opportunities

Baiman (1990) suggested that an analysis of the use of reputation in an implicit contracting environment will provide greater understanding of the effect of action choice on reputation as it endogenously arises in a multiperiod setting. This study is one of the first in the area of cost reporting, reputation, and the use of benchmarks. Since implicit contracts are far more numerous than explicit ones, they provide a large and important field for further research. Managerial accounting research will benefit from the use of high quality data bases to test questions of practical relevance and importance.

Appendix

Proof of Proposition I:

In the no information model (when $\partial U/\partial I > 0$ and $dI/dq > 0$), the physician's first-order condition can be signed as follows

$$\begin{matrix} + & ? & + & + \\ (\partial U/\partial B)(dB/dq) & + & (\partial U/\partial I)(dI/dq) & = 0. \end{matrix} \quad (\text{A.1})$$

Thus (dB/dq) has to be negative implying that $q > q^*$.

Q.E.D.

Proof of Proposition II:

To begin, let $A=0$ and choose $q_0 > q^*$. Then $p(\Omega | q, A)=0$ and from equation (A.1), $(dB/dq) < 0$. Now let $A > 0$, so that $p(\Omega | q_0, A) > 0$ and $V_\Omega(dp/dq) > 0$. Subtracting this disutility term from equation (A.1), the first-order condition at q_0 , (equation 5), is now negative and no longer at an opti-

¹⁰ Personal interviews were undertaken in eight of these institutions to determine if something other than the provision of information could have caused a reduction in ancillary services. There appeared to be no single practice common to the group of eight that would explain the results, other than the information environment. A self-selection bias might arise if these hospitals perceive themselves to be relatively high cost providers and are more concerned with cost containment. This bias would probably increase the difficulty of finding significantly negative coefficients, however.

mum. Thus $(dE(H)/dq) < 0$. Since the probability of being detected over-treating is increasing in q , that is, $(dp/dq) > 0$, as q gets larger, the whole term $V_{\Omega} * (p(\Omega | q, A))$ grows larger, and $dE(H)/dq$ grows increasingly negative. In order to move toward an optimum, q must decrease. The physician will decrease q until $dB/dq \geq 0$.

Signing the first-order condition given q_0 :

$$(dH/dq)_{q_0} = \left(\frac{\partial U}{\partial B} \right) \left(\frac{dB}{dq} \right) + \left(\frac{\partial U}{\partial I} \right) \left(\frac{dI}{dq} \right) - V_{\Omega} \left(\frac{dp}{dq} \right) < 0. \quad (A.2)$$

Now, using the second derivative and examining an increase in A , $d(dp/dq)/dA > 0$. The probability of being detected as overtreating increases as the number of services ordered increases and as the frequency, detail, and quality of information increases. Here, assume q is constant. Then as A increases, the probability of being detected increases and $dE(H)/dq$ becomes increasingly negative. The more A increases, the more negative $-[V(\Omega)(dp/dq)]$ becomes and the more negative $dE(H)/dq$ becomes. If the physician then increases q , everything becomes even more negative. But as the physician decreases q and q approaches q^* , $dE(H)/dq$ becomes less negative and approaches 0. The physician has no incentive to decrease below q^* because the second partial is positive and at $q \leq q^*$, $p(\Omega | q, A) = 0$. Therefore, he or she must order services q_A such that $q^* < q_A < q_0$. Thus the physician will select a lower q as A is increased.

Q.E.D.

References

- Baiman, S. 1990. Agency research in managerial accounting: A second look. *Accounting Organizations and Society* 15 (Fall): 341-71.
- Beaver, W. H. 1968. The information content of annual earnings announcements. *Journal of Accounting Research* 6 (Supplement): 67-92.
- Berry, C., P. Held, B. Kehrer, L. Marheim, and U. Reinhardt. 1980. Canadian physicians' supply response to universal health insurance: The first years in Quebec preliminary results. *Physicians and Financial Incentives*. Washington, D.C.: U.S. Government Printing Office.
- Coombs, R. W. 1987. Accounting for the control of doctors: Management information systems in hospitals. *Accounting, Organizations and Society* 12 (4): 389-404.
- Curran, W. 1977. Hospital power and medical responsibility: Medical-staff bylaws. *The New England Journal of Medicine* (3 Feb.): 264-65.
- Eisenberg, J. 1986. *Doctors' Decisions and the Cost of Medical Care*. Ann Arbor, MI: Health Administration Press Perspectives.
- Feldman, R., F. Sloan, and L. Paringer. 1981. Compensation arrangements between hospitals and physicians. *Bell Journal of Economics* 12: 155-70.
- Feldstein, P. 1983. *Health Care Economics*. New York: John Wiley and Sons.
- Freiman, M., R. Ellis, and T. McGuire. 1989. Provider response to Medicare's pps: Reductions in length of stay for psychiatric patients treated in scatter beds. *Inquiry* 26 (Summer): 192-201.
- Fuchs, V. 1986. *The Health Economy*. Cambridge, MA: Harvard University Press.
- Gold, M., and D. Hodges. 1989. Health maintenance organizations in 1988. *Health Affairs* (Winter): 125-38.
- Gordon, G., S. Sefcik, and J. LoGerfo. 1991. Cost competitiveness of a teaching hospital as a system of obstetrical care. *Western Journal of Medicine* 155(6): 616-20.
- Greene, J. 1991. Hospitals eyeing physicians' practice patterns. *Modern Healthcare* (29 April): 30-31.
- Hadley, J. 1979. Physician participation in Medicaid: Evidence from California. *Health Services Research* 14: 266-80.
- _____, S. Zuckerman, and J. Feder. 1989. Profits and fiscal pressure in the prospective payment system: Their impacts on hospitals. *Inquiry* 26: 354-65.

- Harris, J. E. 1977. The internal organization of hospitals: Some economic implications. *Bell Journal of Economics* 8 (Autumn): 467-82.
- Holthaus, D. 1988. The Patrick case: Will it hinder peer review? *Hospitals* (June 20): 56.
- Jensen, M., and W. Meckling. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* (October): 305-60.
- Kmenta, J. 1986. *Elements of Econometrics*, 2d ed. New York: Macmillan Publishing Company.
- Lawrence, C. 1990. The effect of ownership structure and accounting system type on hospital costs. *Research in Governmental and Nonprofit Accounting* 6: 36-60.
- Pear, R. 1993. Health-care costs up sharply again, posing new threat. *New York Times* (5 Jan.): A1.
- Maurice, T. 1987. Management control systems for non-profit health care organizations. Working paper, Seattle University, Seattle, WA.
- Menke, T. 1990. Impacts of PPS on Medicare Part b expenditures and utilization for hospital episodes of care. *Inquiry* 27 (Summer): 114-26.
- Noreen, E., and N. Soderstrom. 1993. Are costs strictly proportional to their cost drivers? Evidence from hospital service departments. *Journal of Accounting and Economics*.
- Rice, T. 1983. The impact of changing Medicare reimbursement rates on physician-induced demand. *Medical Care* 21: 803-15.
- Robinson, J., and H. Luft. 1985. The impact of hospital market structure on patient volume, average length of stay, and the cost of care. *Journal of Health Economics* 4 (4): 333-56.
- Rosen, S. 1985. Implicit contracts: A survey. *Journal of Economic Literature* 23 (September): 1144-75.
- Soderstrom, N. 1991. Are reporting errors under PPS random or systematic? *Inquiry* 27 (Fall): 234-41.
- Thorpe, K. 1988. Why are urban hospital costs so high? The relative importance of patient source of admission, teaching, competition, and case mix. *Health Services Research* 22 (6): 821-36.

Perceived Social Needs, Outcomes Measurement, and Budgetary Responsiveness in a Not-for-Profit Setting: Some Empirical Evidence

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SYNOPSIS AND INTRODUCTION: This study develops an empirical model to examine the responsiveness of budgetary allocations to public demand for services and the resulting outcome-generating activities in the New York City Police Department (NYPD). The analysis combines nonfinancial measures of the results of operations with budgetary and financial measures. The model explicitly incorporates efficiency and effectiveness measures and reflects as well the interactive nature of outcome-generating activities in the NYPD. The setting investigated suggests that, as in for-profit managerial accounting, task complexity and budgetary slack may be important conditioning variables in performance assessment.

The empirical analysis uses publicly available NYPD data. We find evidence that budgetary provisions are responsive to perceived social needs. In addition, task complexity is a pervasively important determinant of both budgetary allocations (a major cost-driver) and the effectiveness of the police department in achieving specific outcomes. The data also suggest that the department may rely extensively on budgetary slack to cope with rapid changes in demand. The nature of the outcome-generating activities of the organization is illustrated in the responsiveness of outputs and outcomes to increased inputs. These results illustrate both the feasibility and the potential usefulness of comprehensive performance evaluation in the not-for-profit sector.

The next section of the paper provides background on the empirical research issues and a brief review of relevant academic research. The empirical model is

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developed in section II. Section III reports the results of the model estimation and hypothesis tests. We discuss the implications of the results in section IV.

Key Words: *Not-for-profit, Task complexity, Budgetary slack.*

Data Availability: *Available from the authors when studies currently underway are complete.*

I. Background

THE objective of a not-for-profit (NFP) organization is, by definition, to achieve socially desired nonfinancial goals. Thus, the measurement of NFP efficiency and effectiveness in producing certain outcomes requires that financial and nonfinancial measures be combined for either inputs or outputs. The current most widely used NFP model reports receipts of contributions and expenditures for budgetary stewardship reporting only and ignores nonfinancial outcomes measurement.

Recent research has focused on the role of line-item budgeting that limits expenditures for individual factor inputs (e.g., Mensah and Li 1993¹; Hayes and Millar 1990; Ramanathan 1982). Darrough (1989), however, shows that in cases when the production function is not fixed, that is, when inputs are substitutable, cost-constraining schemes will not necessarily produce optimal outcomes.² In those cases in which NFP organizations face resource levels substantially below those required to fulfill the organization's mandate, measurement of outcomes becomes all the more important in order to achieve effective use of scarce funds.

II. The Empirical Model and Research Design

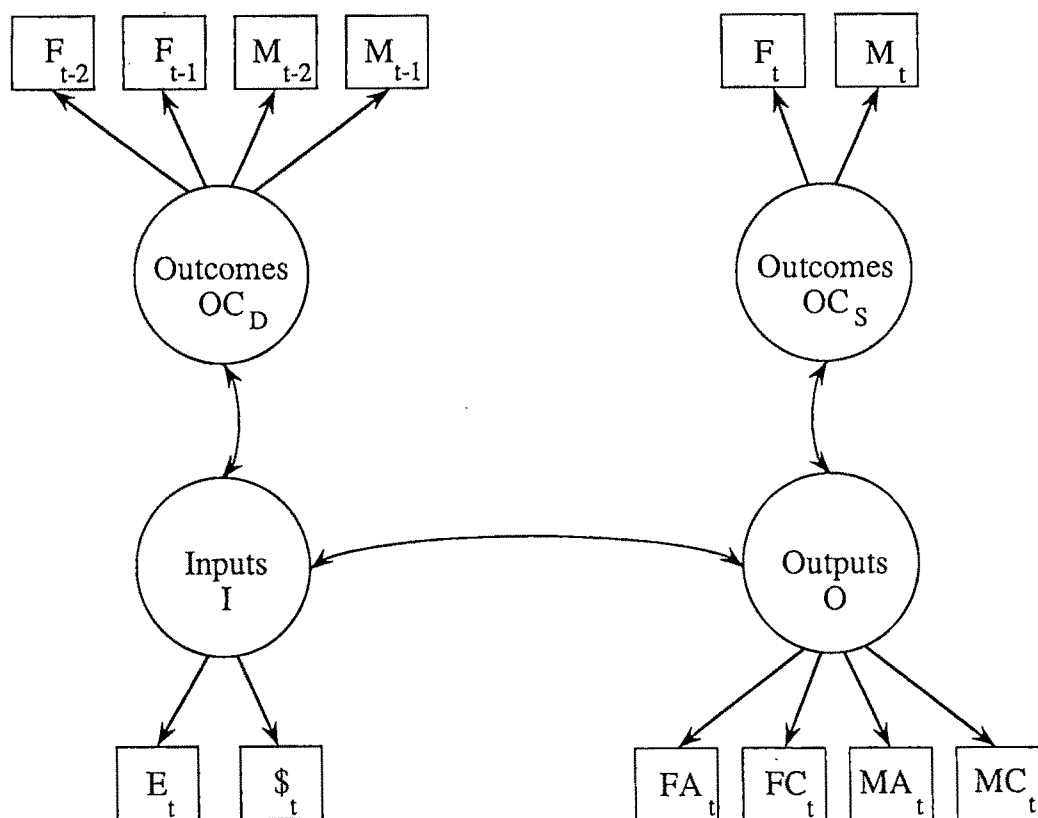
The outcome-generating behavior of a NFP resulting from changes in budgetary responsiveness to changes in social needs may be evaluated by examining successively: (1) the responsiveness of budgetary provisions to prior changes in demand for services; (2) the changes in outputs generated from changes in budgetary provisions; and (3) the changes in outcomes produced as a function of outputs. The general NFP outcome-generation process as modified for the NYPD is shown in figure 1. Outcomes are nonfinancial measures of the NFP's implied demand for and supply of services. For example, for the NYPD, an increase in the rate of reported felonies in a prior period represents an increase in demand for NYPD services. Inputs include both budgetary allocations and nonfinancial resources acquired (e.g., employees and operating assets). Inputs are expected to be responsive to changes in demand for the NFP's services. Outputs are measures of levels of activity, for example, number of arrests made, of a NFP. Increasing output activities for a given level of inputs implies that the NFP is utilizing resources more efficiently. When changing outcomes, such as a reduction in reported felonies, are associated with a change in related output activities, the NFP is said to be more effective in meeting social needs.

However, specific measures must be devised for determining the responsiveness of budgetary resource provisions (from funding agencies) to changes in demand for services. If such

¹ Mensah and Li (1993) provide a comprehensive review of this research.

² Funding agencies frequently perform operational or program audits, but these are usually intended to ascertain that the organization is complying with legal and budgetary constraints on expenditures, classes of persons served, and activities engaged in by the organization. An American Accounting Association (1988) study indicates that outcomes or effectiveness measurement is rarely a part of program audits. Indeed, the only measures commonly employed are activity measures such as number of clients served or number of appointments or sessions, rather than satisfaction of the needs of the client. Such failure to measure the effectiveness of a NFP organization may work to the detriment of a responsible agency or, at a minimum, may not correctly attribute the effectiveness of the agency.

Figure 1



provisions are relatively unresponsive, then the NFP organization will either be unable to achieve its mission or will operate with *budgetary slack* adequate enough to cope with unforeseen shifts in demand.³ In addition, measures are required for monitoring and controlling the conversion of budgetary resources to productive activities defined in terms of the organization's mandate or objectives. Finally, measures of the process of converting productive activities into desired outcomes must be developed.⁴

The *quality*, the relevance and reliability, of the chosen measures becomes relevant in both the allocation and utilization of scarce budgetary resources, which affects the levels of desired

³ Apparent lack of budgetary responsiveness to changes in demand may result from a variety of causes, including relatively long lead times for budget preparation compared to rapid changes in demand; constrained, unreliable, or volatile revenue sources for the budgetary agency; or the manner in which budgets are determined, which may ignore important sources of information, including operating unit activity levels and demand for services.

⁴ This has proven to be the most difficult aspect of comprehensive performance evaluation in the public sector, where mandates are frequently ambiguous or extremely complex. In an agency that has multiple targets, for example, a social services organization with responsibilities ranging from foster child care to the homeless to elderly citizens suffering from Alzheimer's disease, performance evaluation involves decisions about task priorities, the appropriate level of aggregation, and specific outcome measures.

outcomes and may affect the incentives for, and likelihood of, striving to develop more efficient production methods.^{5,6}

For organizations with multiple objectives, the relative *complexity* of the differing tasks may be an important determinant of how effectively the organization achieves its mission, as well as a major cost driver. Varying levels of task complexity for different types of operations may require different performance evaluation standards. From the results of Banker et al. (1992) in the for-profit sector, it is implied that task complexity influences the setting of budgetary standards.

We use association tests to examine these questions. First, we examine the responsiveness of budgetary provisions to changes in demand for services. A crucial step in applying the model is to identify the strategic mission of the NYPD that will define the outcome measures. Ambiguous goals such as maintaining law and order can be specifically stated as investigating and solving criminal complaints. Reportedly, the NYPD regards changes in felony complaints reported as the ultimate barometer of the relative success or failure of the efforts of the department (*New York Times* 1992a).⁷ The decrease in felony complaints in midtown Manhattan for the first four months of 1992 was attributed to “the presence of more police officers on patrol, augmented by an increase in private security guards hired by business groups” (*New York Times* 1992b, B-3).⁸ Interestingly, the less effort-demanding misdemeanor complaints are not mentioned in either article.

If the budgetary system is responsive to changes in demand for services (complaints), then we would expect budgetary allocations to be increasing with felony complaints. To the extent that investigation of misdemeanors consumes police department resources, the budget should be responsive to these as well. Specifically, we estimate the following regressions:

$$I_t = a_1 + b_{f,t} OC_{f,t-n} + b_{m,t} OC_{m,t-n} + e_1 \quad (1)$$

$$C_t = a_2 + c_{f,t} OC_{f,t-n} + c_{m,t-n} OC_{m,t-n} + e_2 \quad (2)$$

$$I_t = a_3 + d_t C_t + e_3 \quad (3)$$

where $OC_{f,t-n}$ is felony complaints and $OC_{m,t-n}$ is misdemeanors in a prior period n (the implied demand for services); I_t is budgeted police officers for the current period, nonfinancial inputs; C_t (“costs”) is budgeted operating dollars in the current period (financial inputs); a , b , c , and d are ordinary regression coefficients; and e is an error term.

⁵Banker et al. (1992) provide an overview of the for-profit manufacturing overhead cost driver literature in which the issues very closely parallel those being considered here. The central point of their paper is that if important cost drivers exist, in addition to the traditional volume measures (e.g., direct labor hours and product units), then the use of volume measures alone may result in distortions in numbers used in economic decision making. They observe that “[a]ctivity analysis aids in the identification of opportunities for process and product improvement, and cost reductions.”

⁶A series of early studies by the NYC Rand Institute of the NYPD found that *easily obtainable* measures of activity were commonly used, for example, number of labor hours worked, which, although possibly logical on an a priori basis, had not been examined for their relationship to the department’s ultimate mission of improving public safety (NYC Rand Institute 1970, 1972, 1973). Indeed, the study found that labor hours worked were unrelated to, that is, uncorrelated with, the changing demand for services (crime rates) or to arrests and cases cleared. The studies recommended revisions to the performance evaluation system to focus more clearly on the department’s mission.

⁷A search of the press and relevant journals for the period of the study (1982–86) finds frequent reference to crime statistics but no direct discussion of the objectives or mission of the NYPD. We assume that such objectives have not undergone radical change in the seven intervening years.

⁸The articles cite a debate among experts in criminal statistics and the NYPD regarding the correct attribution of the decline in reported felonies. The experts propose that the decline may be merely a temporary fluctuation in the felony rates or the result of demographic shifts unrelated to the efforts of the NYPD. The NYPD maintains that the decline is a result of major crime control efforts undertaken by the department in recent years. The issue is difficult to resolve in the absence of accepted models of effectiveness measurement.

We consider three specific cases: high budgetary responsiveness to demand, low (or near zero) responsiveness, and budgetary slack. If in equations (1) and (2) the budgetary allocations are highly responsive to demand for services, then a_1 and a_2 should be insignificant, the b s and c s should be positive and significant, and the explanatory power of the regression should be high.⁹ Finally, if the NYPD relies on at least some measure of budgetary slack, then size is likely to be an additional significant factor in the regression, in which case both intercepts, a_1 and a_2 , and the b s and c s should be significant.¹⁰

As a result of line-item budgeting, we expect the inputs and costs in equation (3) to be highly positively related to one another, implying that individual operating units may lose degrees of freedom and thus be less efficient unless substitutions (for example, temporary personnel transfers) from one precinct to another, altering police strategies, or other such modifications are possible (Darrough 1989).¹¹

In a second series of regressions, we examine the relationships between outputs, O_j , and budgetary allocations (inputs), I and C ,

$$O_{j,t} = a_4 + b_4 I_t + e_4 \quad j = 1, \dots, 4. \quad (4a-4d)$$

$$O_{j,t} = a_5 + b_5 C_t + e_5 \quad j = 1, \dots, 4 \quad (5a-5d)$$

$$O_{k,t} = a_6 + b_6 O_{l,t} + e_6 \quad (6a-6b)$$

where j represents (1) felony arrests, (2) felony cases cleared, (3) misdemeanor arrests, and (4) misdemeanor cases cleared; I_t budgeted police officers; C_t budgetary dollars; k felony or misdemeanor cases cleared; and l felony or misdemeanor arrests.¹² We expect outputs to be increasing functions of budgetary allocations. Felonies are serious offenses against persons or property and are likely to require more police investigative activity than misdemeanors. That is, felonies are relatively more complex and significant cost-drivers in the budgetary process.

Equations (6a-6b) provide information on the relationships between alternative output measures, arrests, and cases cleared, which should be strongly and positively associated. These relationships are relevant because it is necessary to understand the interrelationships among alternative measures of the output variable in assessing the efficiency and effectiveness of a NFP.

To investigate the relationships between output activities and outcome generation, we form the following regressions:

$$O_{fc,t} = a_{7a} + b_{f,t-n} OC_{f,t-n} + e_{7a} \quad (7a)$$

$$O_{mc,t} = a_{7b} + b_{m,t-n} OC_{m,t-n} + e_{7b} \quad (7b)$$

⁹ As the scales differ for the variables (for example, costs are measured in dollars whereas nonfinancial inputs are absolute numbers of police officers per precinct), the *a priori* absolute magnitudes of the b s cannot be precisely specified in advance without knowing the relative levels of the variables.

¹⁰ A significant b assumes at least some responsiveness, in addition to slack (significant a). The issue of what constitutes a high or low R^2 has obviously not been resolved. Moreover, as no research, to the best of our knowledge, has investigated these issues in this setting before, we have no standards for comparison. However, we assume that most researchers would agree that an R^2 in the upper third of the range (0 to 1) is *relatively* high, and in the lower third of the range is *relatively* low.

¹¹ Although manpower levels are fixed in the usual sense by budgetary provision, NYPD officials have some latitude to redeploy police officers on a short-term basis for both emergency (e.g., disasters and other major crises) and routine (e.g., crowd and traffic control) requirements.

¹² Cases are cleared when the NYPD determines that a satisfactory disposition of the case has occurred (e.g., referring a case for prosecution, official dropping of a complaint, etc.). Observe that arrests may be greater than, equal to, or less than cases cleared.

$$OC_{f,t+1} = a_{8a} + b_{fc,t} O_{fc,t} + e_{8a} \quad (8a)$$

$$OC_{m,t+1} = a_{8b} + b_{mc,t} O_{mc,t} + e_{8b} \quad (8b)$$

where *fc* and *mc* are felony and misdemeanor cases cleared; *f* and *m* are felony and misdemeanor complaints; and *t-n* represents prior or current period complaints. In equations (7a) and (7b) the strength of the association between prior and current complaints and cases cleared indicates the degree of task complexity. The closer the *b* is to 1, the less difficult on average is the task, that is, the more completely complaints filed are resolved. By examining both prior and current complaints, we allow for a time lag in clearing the complaints.

In order to investigate whether or not the crime rate appears to be affected by police activity, we regress outcomes (felony and misdemeanor complaints) in one period, *t+1*, on cases cleared in the prior period, *t*. A decrease in criminal or misdemeanor complaints is regarded as a favorable outcome in this case. Therefore, if outcomes are responsive to prior period police activity, we expect the *b* to be negative. Although both felony and misdemeanor complaint rates are likely to be associated with a number of demographic and economic factors in addition to police activity and effectiveness, we expect misdemeanors to be more responsive.¹³ However, we would expect the *b* to be small in absolute magnitude since a single period's adaptation is likely to be low.

III. Data and Analysis

The NYPD data were collected from the New York City Library and Archives and include felony and misdemeanor statistics (NYPD 1982-86) and operating budget (NYC 1982-86) data. Statistics for both felonies and misdemeanor complaints, arrests, and cases cleared are compiled for a variety of city, state, and federal authorities and follow standard categorical guidelines. Both operating budget and crime statistics are available by precinct, the fundamental operating unit of the NYPD. The 75 precincts are distributed over the five New York City boroughs: the Bronx, Brooklyn, Manhattan, Queens, and Staten Island. Operating budgetary data for individual precincts are available in the records of the New York City Finance Department. Budgets are prepared and adopted during the year prior to the operating year in question and thus reflect information available to the budgetary authorities until a short time before the end of the fiscal year. Both the crime statistics and the budgetary data are for annual periods with the same fiscal year-end. The budgets are developed by the usual line-item process and include appropriations for both employee level and dollar amounts for each precinct.¹⁴

The period of time chosen for the study, 1982-86, is one of rapid change for the NYPD. The city was recovering financially from the financial distress of the 1970s. A downward spiral of tax and service revenues resulted from several factors, including numerous organizations relocating away from the city. The national recession of 1980-82 exacerbated these effects with the outcome being a substantial reduction in both dollar budget resources and manpower levels across city

¹³ An interesting line of enquiry would be to examine the role of demographic and economic factors in this context. However, to our knowledge, no compilations of such data are available on a precinct basis.

¹⁴ Capital budget data are available, but not on an individual precinct basis. The reason for this is that most capital expenditures (e.g., the purchase of new police cars) are made on a negotiated contract basis, the contract frequently covering all expenditures for items of a given type over the whole NYPD. As a consequence, multiple precincts are represented in a given contract and the data publicly available are insufficient to correctly attribute the expenditures to a single precinct. However, we believe it reasonable to assume that the budgetary allocations of major importance to the mission of the NYPD are those associated with acquisition of manpower and day-to-day operating expenditures for individual precincts.

agencies. In the period under study, the economy and the attendant budgetary allocations rebounded rapidly in the NYC area. As a consequence, this period provides an opportunity to evaluate the budgetary issues raised in this article.

Those precincts with one or more missing items in a given year were eliminated; at least 72 observations are available for every year. Table 1 provides descriptive statistics for criminal and budgetary data items for the five years included in the study. The data provide insights into the nature of police operations. First, average felony complaints reported per precinct dropped by approximately 9 percent from 1982 to 1983 and an additional 4 percent from 1983 to 1984. Officials report that serious crime rates commonly rise during economic recessions and drop significantly following the end of the recession; 1982 was the last year of a major recession.¹⁵ Of the felony complaints made, on average only 20 percent resulted in arrests over this time period. The proportion of arrests to complaints rose by 41 percent over the period. The number of felony cases cleared as a proportion of arrests remained essentially stable at 80 percent over the period. As for misdemeanors, complaints increased monotonically by 32 percent over the period. Approximately two-thirds of all misdemeanors resulted in arrests, which is roughly three times the rate for felonies.¹⁶

The average number of budgeted police officers per precinct dropped slightly in 1983 and gradually increased thereafter, representing a total increase of 4 percent over the period. Thus, although felony and misdemeanor complaints varied widely over the period, the number of officers available remained essentially stable. The average operating budgets increased slightly (2 percent) from 1982 to 1984, rose sharply by 22 percent in 1985, and increased by 3 percent in 1986. The increase in 1985 can be attributed to the improved financial health of the city.¹⁷

Table 2 presents the results of estimation of the unweighted and weighted variable regressions for equation (1), the association between demand for police services as measured by prior period felony and misdemeanor complaints, and police officer (employee) allocations. The unweighted variables regressions show high explanatory power, as measured by R^2 . Observe that adding additional yearly observations of a variable ($t-2$) in 1984 does not enhance the explanatory power substantially (1985-86 have a similar result and are therefore not shown).

The relatively large R^2 s suggest that size may be an important factor in these regressions. To examine this possibility, we weight all variables by the dollar budget allocations for two years prior to the test year.¹⁸ The budget-weighted variable results indicate that much of the explanatory power of the regressions was a result of size alone. The coefficient on felony complaints is positive and significant at 0.05 or better in 1984 and 1985, whereas misdemeanor complaints is significant in 1986 only. It is interesting to observe that the strongest regression is for 1985, the year of the

¹⁵ Officials also report that crime reporting practices have not changed during the period of the study but have remained stable; that is, the drop is not attributable to changes in the categories of, for example, felonies and misdemeanors.

¹⁶ Misdemeanor cases cleared exceeded arrests in some years. The discrepancy is explainable by settlement of a complaint without an arrest being made.

¹⁷ The NYPD operating budgets and, indeed, the New York City budgets, do not seem to be influenced in any major way by inflation rates over the study period. The inflation rate was approximately 4 percent in 1982 (having dropped substantially from the rates of the late 1970s and early 1980s), falling to less than 2 percent in 1986. Putting it differently, the descriptive statistics suggest that any such effects are likely to be swamped by the city's recovery from financial distress.

¹⁸ This weighting scheme is closely analogous to the usual practice in capital market studies of weighting market equity returns data, as well as independent variables, by the beginning-of-period price. This particular weighting scheme is employed for several reasons, including the relatively high correlations between budget dollars and the remaining variables, the desirability of using a beginning-of-period measure, and the central focus of this study on the responsiveness of budgets to demand for services and the relationship between resources provided (budgets) and the resulting outputs and outcomes of the NYPD.

Table 1
Descriptive Statistics for Variables across Precincts
Means (Standard Deviations)

	1982	1983	1984	1985	1986
Sample size-N	74	72	74	75	75
Felonies-complaints	8,298 (4,359)	7,529 (4,057)	7,188 (3,876)	7,138 (3,819)	7,300 (3,967)
Arrests	1,448 (923)	1,466 (944)	1,516 (1,056)	1,508 (1,021)	1,726 (1,187)
Cleared	1,167 (643)	1,218 (695)	1,241 (730)	1,253 (744)	1,388 (822)
Misdemeanors-complaints	7,983 (4,658)	8,562 (5,607)	8,946 (6,319)	10,100 (7,154)	10,556 (5,929)
Arrests	5,300 (4,551)	5,972 (5,343)	6,275 (5,753)	7,252 (6,833)	6,581 (5,441)
Cleared	5,141 (4,021)	5,970 (4,969)	6,433 (5,655)	7,396 (6,514)	7,258 (5,105)
Employees	195 (53)	185 (47)	187 (50)	196 (52)	202 (57)
Operating budget	4,211,666 (1,130,603)	4,350,405 (1,085,700)	4,330,347 (1,135,832)	5,304,470 (1,389,186)	5,477,491 (1,530,005)

Table 2
Association between Demand for Police Services (Prior Period Complaints) and
Budgeted Employee (Police Officer) Allocations: Equation (1)
(Unweighted and t-2 (\$) Budget-Weighted Variables)

$$I_t = a_1 + b_{f,t}OC_{f,t-n} + b_{m,t}OC_{m,t-n} + e_t$$

Year	Independent Variables					R ²
	Intercept	Felony Complaints t-2	Felony Complaints t-1	Misdemeanor Complaints t-2	Misdemeanor Complaints t-1	
<i>Unweighted</i>						
1984	102.87**		0.008**		0.003**	0.84
	100.37**	0.001	0.007*	0.002	0.001	0.84
1985	110.37**		0.009**		0.002**	0.81
1986	114.41**		0.009*		0.002**	0.75
<i>Weighted^{1,2}</i>						
1984	4.14**		2.200*		-0.310	0.04
1985	3.78**		3.370*		1.160	0.22
1986	3.84**		2.430		1.990*	0.17

*Significant at 0.05.

**Significant at 0.01 or better.

¹Intercept stated x 10⁵.

²Felony and misdemeanor complaints coefficients stated x 10³.

22 percent increase in dollar budgetary allocations.¹⁹ As the intercept is significant in every year for both weighted and unweighted variables, the significant felony and misdemeanor coefficients are positive, but the explanatory power of the weighted regressions is relatively low, we conclude that budgetary slack may be an important factor in operations. That is to say, size is the single most

¹⁹Regressions using changes in the variables instead of budget-weighted variables have slightly higher R², but the pattern of significance is the same as that reported for the budget-weighted variables.

Table 3
Association between Demand for Police Services (Prior Period Complaints) and
Budgeted (Dollar) Allocations: Equation (2)
(t-2 (\$) Budget-Weighted Variables)

$$C_t = a_2 + c_{f,t}OC_{f,t-n} + c_{m,t}OC_{m,t-n} + e_2$$

Year	Independent Variables			R^2
	Intercept	Felony Complaint t-1	Misdemeanor Complaints t-1	
1984	0.98**	50.19*	-15.97	0.04
1985	1.04**	89.31**	24.32	0.19
1986	114.41**	56.66**	49.95*	0.13

*Significant at 0.05 or better.

**Significant at 0.01 or better.

important explanatory variable, and the size-weighted dollar budget changes are mildly responsive to changes in the background felony and misdemeanor complaints.

Table 3 presents the results of weighted-variable regressions of dollar budget allocations on one-period lagged felony and misdemeanor complaints. The results are qualitatively similar to those for employee allocations. A comparison of tables 2 and 3 indicates, however, that employee (police officer) allocations are explained marginally better by background demand for services (felony and misdemeanor complaints) than are dollar budget allocations. This accords well with intuition in that such adjustments as are being made in allocations in response to demand for services would be primarily reflected in changes in the direct resources required to deal with the demand, employees.

Table 4 provides the results of the regressions of employees (police officers) on dollar budget allocations, equation (3). It is clear that the two variables are essentially the same in terms of information content. That is, as both are the result of a single line-item budgetary process and are effectively coterminous, the two are for the most part indistinguishable.

The results of the regressions of equations (4a-4d), which examine the relationships between budget allocations and felony and misdemeanor arrests and cases cleared, are presented in Table 5. As employees and dollar budgets are nearly perfectly correlated, results are shown for employees only, and proposed equations (5a-5d) are omitted. The results are of particular interest and importance for this study. The 1984 regressions indicate very poor fits with essentially zero explanatory power. In addition, although we expect the outputs, arrests, and cases cleared to be

Table 4
Association between Employees (Police Officers) and Budgeted (Dollar)
Allocations: Equation (3)
(Unweighted and t-2 (\$) Budget-Weighted Variables)

$$I_t = a_3 + d_t C_t + e_3$$

<i>Employees_t</i>	<i>Independent Variables</i>			<i>R</i> ²
	<i>Intercept</i>	<i>Dollar Budget_t</i> (Unweighted)	<i>Dollar Budget_t</i> (Weighted)	
1984				
(1)	-2.96*	4.38**		1.00 ¹
(2)	0.00		4.40**	0.97
1985				
(1)	-2.74	3.74**		1.00 ¹
(2)	0.00		3.78**	0.97
1986				
(1)	-1.75	3.71**		0.99
(2)	0.00		3.67**	0.97

*Significant at 0.05 or better.

**Significant at 0.01 or better.

¹Rounds to 1.00 at two decimals.

increasing in budgetary allocations, the coefficients are negative and insignificant. On the other hand, the data show that, beginning in 1985, outputs are increasing in budgetary allocations. This pattern is particularly strong for felonies, the most serious crimes and the primary focus of the department, the explanatory power being several times that for misdemeanors. Thus, a portion of the new resources allocated to the department beginning in 1985 appears to have been targeted directly at solving the most serious crimes. Put simply, input increases have led to output (or outcome) increases. Thus, we can conclude that the NYPD utilized the increased resources to improve its effectiveness in achieving its primary mission.

The tests of the relationships among arrests and cases cleared for both felonies and misdemeanors, equation (6), are presented in table 6. The results provide no surprises, given the prior results. Specifically, the *R*²s are all very high, somewhat more so for misdemeanors than felonies. The coefficients are all significant and the beta coefficients for misdemeanors are near one. Once an arrest for either a felony or misdemeanor is made, there is a high probability that the case will be cleared; the challenge is to make the arrest for the more complex task, felonies.

This latter issue is addressed in the regressions in table 7 for equations (7a-7b), the association between cases cleared and current and prior period complaints. Felonies cleared are much less

Table 5
Association between Budget Allocations and Felony and Misdemeanor Arrests
and Cases Cleared: Equation (4)
(t-2 (\$) Budget-Weighted Variables)

$$O_{j,t} = a_4 + b_4 I_t + e_4 \quad j = 1..4$$

<i>Dependent Variable</i>	<i>Independent Variables</i>		
	<i>Intercept¹</i>	<i>Employees_t</i>	<i>R²</i>
1984			
Felony arrests	7.02**	-0.07	0.02
Felonies cleared	3.79**	-2.12	-0.01
Misdemeanor arrests	17.06**	-6.91	-0.01
Misdemeanors cleared	16.80**	-5.45	-0.01
1985			
Felony arrests	-4.19**	16.65**	0.22
Felonies cleared	-2.91**	12.60**	0.28
Misdemeanor arrests	-16.21	70.89**	0.11
Misdemeanors cleared	-13.88	66.51**	0.11
1986			
Felony arrests	-6.73**	22.58**	0.4
Felonies cleared	-4.36**	15.96**	0.49
Misdemeanor arrests	-7.30	46.73**	0.10
Misdemeanors cleared	-9.40	54.67**	0.16

*Significant at 0.05.

**Significant at 0.01 or better

¹Stated x 10⁴

²As the results for dollar budget allocations are similar across the years, the regression results for dollar budget allocations (5a-5d) are not shown.

responsive to prior and current felony complaints than misdemeanors cleared are to misdemeanor complaints. In all instances, cases cleared are most closely associated with the current complaints. That is, most complaints will be rather quickly followed by an arrest, *if an arrest is going to be made at all*. Put differently, the longer the period of time that has elapsed since the commission of an offense, the less likely the complaint will result in an arrest. The results from table 7, when considered with those from table 5, the responsiveness of outputs to budgetary allocations, indicate that the NYPD is capable of improving its performance, i.e., its effectiveness with regard to the most complex of tasks, if provided with adequate resources.

Table 6

Association between Felony and Misdemeanor Cases Cleared and Arrests: Equation (6)
(t-2 (\$) Budget-Weighted Variables)

$$O_{k,t} = a_6 + b_6 O_{1,t} + e_6$$

Dependent Variable	Independent Variables			R ²
	Intercept	Felony Arrests <i>t</i>	Misdemeanor Arrests <i>t</i>	
1984				
Felonies cleared	0.00009**	0.56**		0.80
Misdemeanors cleared	0.00009**		0.96**	0.97
1985				
Felonies cleared	0.00006**	0.65**		0.91
Misdemeanors cleared	0.00014**		0.94**	0.99
1986				
Felonies cleared	0.00006**	0.64**		0.92
Misdemeanors cleared	0.00028**		0.92**	0.95

*Significant at 0.05 or better.

**Significant at 0.01 or better.

Finally, the hypotheses associated with equations (8a-8b), the association between current period (*t*) arrests and cases cleared, the outputs, and future (time period *t*+1) felony and misdemeanor complaints, are examined in table 8. Observe that the year *t*+1 lies outside the study range for 1986 arrests and cases cleared, and consequently we report only the years 1984 and 1985. As a favorable outcome is defined as a decline in the rate of felony and misdemeanor complaints, we would expect the regression coefficient relating the complaints to prior period arrests and cases cleared to be negative. The results simply do not support the hypothesis that police activity in one period will result in a favorable outcome, that is a decline in complaints in a future period, *at least for the period under empirical study here*. The coefficients are positive, which, strictly interpreted, means that an increase in arrests and cases cleared in one period will be followed by an increase in complaints in the next. Felonies did decline, on average, monotonically through the fourth year of the study period, 1985, but the decline was slight between 1984 and 1985; felony arrests and cases cleared were essentially level between 1984 and 1985. Thus, there may have been very little explainable variability relative to the noise in the numbers. However, it is far more likely that any changes in background complaints would occur over relatively long (e.g., three to five years) periods of time.

Table 7
Association between Felony and Misdemeanor Cases Cleared and Current and Prior
Period Complaints: Equations (7a-7b)
(t-2 (\$) Budget-Weighted Variables)

$$O_{fc,t} = a_{7a} + b_{f,t-n} OC_{f,t-n} + e_{7a}$$

$$O_{mc,t} = a_{7b} + b_{m,t-n} OC_{m,t-n} + e_{7b}$$

Dependent Variable	Independent Variables					R ²
	Intercept	Felony	Felony	Misdemeanor	Misdemeanor	
		Complaints t-1	Complaints t	Complaints t-1	Complaints t	
1984						
Felonies cleared	0.0002**	0.35				0.01
	0.0002**		0.073**			0.10
Misdemeanors cleared	-0.0005**			0.999**		0.68
	-0.0004**				0.926**	0.95
1985						
Felonies cleared	0.0002**	0.073**				0.09
	0.0001**		0.096**			0.16
Misdemeanors cleared	-0.0003			0.955**		0.71
	-0.0005**				0.959**	0.97
1986						
Felonies cleared	0.0001*	0.124**				0.16
	0.0001*		0.131**			0.21
Misdemeanors cleared	-0.0000			0.740**		0.79
	-0.0006**				0.937**	0.97

*Significant at 0.05 or better.

**Significant at 0.01 or better.

IV. Summary and Conclusions

Task complexity appears to be a pervasively important consideration in this particular setting, a result consistent with research in the managerial research literature. The mild responsiveness of budgetary allocations to demand for services suggests that the organization may be required in the short term to rely upon budgetary slack in order to achieve its mission. However, these results also indicate that large NFP organizations can be responsive in the short run to changes in the demand for services. Thus, potential gains in efficiency and effectiveness of service delivery, relative to the scarce resources available, may be achieved if NFPs and funding agencies monitor the outcome-generation process.

We conclude that performance evaluation must give careful attention to the underlying nature of performance measures chosen and especially to their relative complexities, modifying the performance evaluation systems to provide separate analyses and weights for each if necessary.

Table 8
Association between Felony and Misdemeanor Complaints in Period t+1 (Outcomes) and Prior
Period Arrests and Cases Cleared: Equations (8a-8b)
(t-2 (\$) Budget-Weighted Variables)

$$OC_{f,t+1} = a_{8a} + b_{fc,t} O_{fc,t} + e_{8a}$$

$$OC_{m,t+1} = a_{8b} + b_{mc,t} O_{mc,t} + e_{8b}$$

Dependent Variable <i>t+1</i> ¹	Independent Variables					<i>R</i> ²
	Intercept	Felony Arrests <i>t</i>	Felonies Cleared <i>t</i>	Misdemeanor Arrests <i>t</i>	Misdemeanors Cleared <i>t</i>	
1984						
Felony complaints	0.0014**	0.65*				0.04
	0.0011**		1.74**			0.15
Misdemeanor complaints	0.0009**			1.02**		0.76
	0.0008**				1.04**	0.77
1985						
Felony complaints	0.0012**	1.12**				0.12
	0.0010**		2.00**			0.19
Misdemeanor complaints	0.0012**			0.71**		0.78
	0.0011**				0.76**	0.79

*Significant at 0.05 or better.

**Significant at 0.01 or better.

¹The dataset comprises the years 1982-1986. For 1984, the year t+1 is 1985; and for 1985, year t+1 is 1986. Therefore, a t+1 year is not available for 1986 and, thus, no regressions have been estimated for this year.

References

- American Accounting Association. 1988. Measuring the performance of nonprofit organizations: The state of the art. *The Report of the AAA Committee on Nonprofit Entities' Performance Measures*. Sarasota, FL.
- Banker, R. D., G. Potter, and R. G. Schroeder. 1992. An empirical analysis of manufacturing overhead cost drivers. Working paper, University of Minnesota, Minneapolis.

- Darrough, M. N. 1989. Variance analysis: A unifying cost function approach. *Contemporary Accounting Research* 5 (1): 199-221.
- Hayes, R. D., and J. A. Millar. 1990. Measuring production efficiency in a not-for-profit setting. *The Accounting Review* 66 (July): 505-19.
- Mensah, Y. M. and S. H. Li. 1993. Measuring productive efficiency in a not-for-profit setting: An extension. *The Accounting Review* 68 (January): 66-88.
- New York City Finance Department. 1982-86. Budget for the City of New York.
- New York City Police Department, Office of Management Analysis, Crime Analysis Section. 1982-86. *Statistical Report: Complaints and Arrests*.
- The New York City Rand Institute. 1970. *The Police Internal Administration of Justice in New York City*.
- _____. 1972. *Police Background Characteristics and Performance*.
- _____. 1973. *New York City's Police: The Background and Performance of the Class of '57*.
- New York Times*. 1992a. In every category, crime reports fell last year in New York City. (March 25): A-1.
- _____. 1992b. Midtown crime reported down sharply. (June 2): B-3.
- Ramanathan, K. V. 1982. *Management Control in Nonprofit Organizations: Text and Cases*. John Wiley.

The Effect of Restructuring Charges on Executives' Cash Compensation

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SYNOPSIS AND INTRODUCTION: Top executives' compensation contracts typically provide for annual incentive awards that link executives' cash compensation and reported earnings. This link has been confirmed empirically by Lambert and Larcker (1987), who document a positive association between the cash compensation of chief executive officers (CEOs) and their firms' contemporaneous earnings performance. The widespread use of earnings-based incentives has prompted concerns that executives may select real decisions and accounting procedures to maximize their earnings-based compensation, irrespective of the impact on the economic well-being of the firm (Kaplan and Atkinson 1989, 724; Watts and Zimmerman 1986, 204). These concerns presume that the earnings-based performance measures specified in compensation contracts are strictly adhered to in setting executive compensation. In practice, however, these plans are administered by compensation committees, who could adjust compensation to prevent executives from engaging in opportunistic behavior. Existing research provides mixed evidence as to whether compensation committees adjust earnings-based compensation. For example, Abdel-khalik (1985) finds evidence that CEO compensation is adjusted in response to accounting procedure changes. In contrast, Healy et al. (1987) find no evidence that CEO compensation is adjusted for the effects of accounting procedure changes on reported earnings.

This study provides evidence suggesting that compensation committees do adjust earnings-based incentive compensation. It documents reliable and systematic evidence that CEOs' cash compensation is adjusted for restructuring charges.

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We investigate a sample of 182 restructuring charges taken by 91 *Fortune* 500 firms between 1982 and 1989. The short-term incentive plans of the sample firms do not include explicit provisions for restructuring charges to be excluded from the definition of earnings used to determine executives' incentive compensation. The empirical analysis, however, indicates that CEO cash compensation is shielded from restructuring charges relative to other components of earnings. The results also suggest that the degree to which executive compensation is adjusted for a restructuring charge depends on the characteristics of the restructuring.

Our evidence is consistent with the hypothesis that compensation committees systematically override the provisions of incentive plans to avoid providing executives with incentives to behave opportunistically. Restructurings typically require a large charge to earnings but can have a positive impact on the economic well-being of a firm. By adjusting executive compensation for restructuring charges, the compensation committee ensures that executives are not deterred from undertaking value-enhancing restructurings.

Key Words: *Compensation committee, Executive compensation, Restructuring charge.*

Data Availability: *The data used in this study are available from the authors on request.*

THE remainder of the paper is presented in five sections. Section I provides institutional background on annual executive incentive awards and reviews prior research in the area. Section II develops testable hypotheses concerning the impact of restructuring charges on executives' annual incentive compensation. Sample selection and variable measurement are described in section III. Section IV presents the empirical analysis and section V concludes the paper.

I. Background

Annual executive incentive plans are almost universal in public corporations; Sibson and Company (1991) indicate that 97 percent of general industry companies have such plans. These plans rely on accounting earnings in establishing the size of annual incentive awards. The performance measures most frequently specified in the plans are pretax earnings and net income.¹ In addition, almost two-thirds of the companies surveyed limit the total companywide pool available for executive incentive awards through the use of a bonus formula. Again, pretax earnings and net income are the performance measures most frequently used in the bonus formula.

Responsibility for overseeing the design and implementation of the annual executive incentive plan is assigned to the compensation committee. This committee generally consists of outside (i.e., nonmanagement) members of the board of directors.² Anecdotal evidence indicates that the compensation committee plays an active role in adjusting the company's reported

¹ The Sibson and Company (1991) survey indicates that pretax earnings and net income are used by 43 percent and 39 percent of firms, respectively. These percentages are not mutually exclusive, as a minority of firms use multiple performance measures.

² The SEC's (1982) survey of 1,200 proxy statements indicates that only 9.6 percent of compensation committee members in large companies (over \$150 million in assets) are employees of the company or one of its affiliates. The corresponding figure for all companies is 12.1 percent.

earnings for the purpose of determining annual incentive awards. This is emphasized in The Conference Board's (1982, 5) study of compensation committees:³

One non-routine situation that can arise involves the committee's authority to make interpretations as to the amount of a year's profit for purposes of incentive awards. As one committee member pointed out, should a company experience some kind of windfall gain, the committee might be faced with a difficult decision as to how much (or how little) of that gain to put in the bonus or other incentive pools. A similar problem might result if a company adopts a change in accounting practices that significantly affects how much profit is shown at the end of the year; the committee's handling of incentive awards in the face of this change might lead award recipients to challenge the fairness of the committee's interpretation.

The potential for compensation committees to adjust the formal definitions of earnings specified in incentive plans for the purpose of determining the awards paid to executives has important implications. Incentive plans employing earnings-based performance measures are frequently criticized for encouraging executives to focus on maximizing short-term reported earnings rather than the economic well-being of the firm (e.g., Kaplan and Atkinson 1989, 724; Rappaport 1990, 103). These criticisms, however, presume that the provisions of the incentive plans are strictly adhered to by the compensation committee. They ignore the potential for compensation committees to actively intervene by overriding the provisions to mitigate adverse incentives. Thus, evidence on the nature and extent of such active intervention by the compensation committee is required to evaluate the import of these criticisms.

Existing empirical research is consistent with the widespread use of earnings-based incentives. For example, Lambert and Larcker (1987) and Sloan (1993) document a positive association between the cash compensation of CEOs and their firms' contemporaneous earnings performance. In addition, both studies find that cash compensation has a higher association with accounting earnings than with other performance measures such as stock returns. Therefore, it is likely that executives consider the effect of alternative actions on their earnings-based incentive compensation. The assumption that compensation committees strictly adhere to the earnings-based performance measures specified in incentive compensation plans has been used to generate hypotheses concerning executives' incentives to engage in opportunistic behavior (Healy 1983; Gaver et al. 1993; and Holthausen et al. 1993). However, to the extent that executives anticipate active intervention by the compensation committee in setting earnings-based incentive compensation, executives' incentives to manipulate earnings will be mitigated. Evidence on the extent to which executives' earnings-based compensation is adjusted to mitigate their incentives to behave opportunistically is mixed.

Abdel-khalik (1985) examines the compensation-earnings relation for the CEOs of firms switching from the FIFO to the LIFO inventory valuation method. He finds evidence of a change in the compensation-earnings relation for the switching firms during the switch period. Thus, his results are consistent with active intervention by the compensation committee in response to such accounting events. Abdel-khalik et al. (1987) provide corroborative evidence. They examine the compensation effects of changes in accounting for pensions and inventory valuation. Their results indicate that compensation increases in the year of the switch relative to the year prior to the

³ Additional anecdotal evidence on intervention by compensation committees includes Earle (1989) and a roundtable discussion of prominent compensation committee members published in *The Wall Street Journal* ("The Hot Seat," 17 April, 1991).

switch, regardless of the impact of the accounting change on reported income. They hypothesize that this corresponds with the cash flow consequence of the accounting changes.

Healy et al. (1987) examine the compensation effects of switches in inventory valuation methods and depreciation methods. In contrast with previous studies, their results suggest that bonus compensation is set using reported earnings. The results are inconsistent with active intervention by the compensation committee in the case of these accounting procedure changes. Defeo et al. (1989) examine whether CEOs' compensation reflects the accounting gain reported by firms making equity-for-debt swaps. Their results suggest that earnings-related compensation increases as a result of the swap transactions. Thus, both studies document evidence consistent with the definition of reported earnings specified in the incentive plans being strictly applied in setting executives' incentive awards. They do not provide evidence consistent with active intervention by the compensation committee.

In summary, existing research is inconclusive as to whether the compensation committee strictly adheres to the contractual provisions or actively intervenes when adherence to the provisions would provide executives with adverse incentives. Thus, as Kaplan and Atkinson (1989, 750) conclude in their review of this research, while active intervention by the compensation committee is theoretically possible, the extent to which it occurs in practice is not clear. This study contributes to existing research by documenting reliable and systematic evidence of active intervention by the compensation committee.

II. Hypothesis Development

The purpose of this paper is to investigate the impact of restructuring charges on executives' cash compensation. Restructuring charges result from the consolidation and/or relocation of operations, the abandonment of operations or productive assets, and the impairment of the carrying value of productive or other long-lived assets. The components of these charges typically include provisions for the termination and/or relocation of operations and employees and reductions in the carrying value of long-lived assets (SEC 1986). Because such charges do not relate to "a single separate major line of business or class of customer," they do not qualify for presentation as losses on the disposal of a discontinued operation under APB Opinion No. 30 (1973). Additionally, since the charges are not both unusual and infrequent, APB Opinion No. 30 does not permit them to be presented as extraordinary items.

The eighties witnessed a sharp increase in restructuring activity and a commensurate increase in the incidence of restructuring charges. The annual surveys reported in *Accounting Trends and Techniques* first include restructuring charges in their compilation of frequently reported losses in 1982. During 1986 and 1987, restructuring charges were the most frequently reported type of losses in these surveys. Pearson and Okubara (1987) report that over \$15 billion in restructuring charges were announced by U.S. public companies in 1986 alone.

Restructuring charges have the potential to provide a powerful test of the intervention hypothesis for three reasons. First, restructuring charges have a diverging impact on reported earnings and the economic well-being of the firm undertaking the restructuring. Brickley and Van Drunen (1990) examine stock price and earnings behavior around a sample of 222 internal corporate restructurings made between 1980 and 1984. They find that the restructuring announcements are associated with small increases in firm value, while the related accounting charges cause large decreases in reported earnings.⁴ Consequently, exposing executives' earnings-based

⁴ We find a similar divergence in that a strong positive association is observed between contemporaneous annual changes in firm value and prerestructuring charge income but no systematic association is observed between contempo-

incentive compensation to restructuring charges provides them with incentives not to undertake these potentially value-enhancing activities. It can therefore be in the interests of both the managers and owners of a firm to shield executive compensation from restructuring charges.

Second, restructuring charges typically have a material impact on reported income. In our sample, the mean ratio of restructuring charge to prerestructuring earnings is 80 percent. The impact of restructuring charges on reported earnings is much greater than the events studied in previous research. For example, the equivalent ratio for the depreciation (inventory) changes studied by Healy et al. (1987) is 9.6 percent (19.3 percent), while the equivalent ratio for the equity-for-debt swaps studied by Defeo et al. (1989) is only 8 percent. Moreover, our sample size exceeds those used in these earlier studies. As a result, we expect our tests to have more power than the tests conducted in previous studies.

Finally, restructuring charges impact the measures of earnings performance most commonly encountered in executives' incentive plans. In particular, restructuring charges are reported as a component of income from continuing operations. As such, restructuring charges are included in the definitions of earnings performance that have been identified in surveys of annual management incentive plans (e.g., Fox 1979, 19; Healy 1983, 37; Sibson and Company 1991, 29). This allows us to examine the extent to which earnings-based compensation is shielded from restructuring charges by the active intervention of the compensation committee. The ability to do this is obscured in previous research. For example the gains associated with the equity-for-debt swaps studied by Defeo et al. (1989) are often classified as extraordinary items, which are frequently excluded from the measures of earnings performance encountered in executives' incentive plans.

Our primary hypothesis, the *intervention hypothesis*, suggests that compensation committees actively intervene to shield executives' earnings-based compensation from the impact of restructuring charges. The term shield is used to capture the extent to which the weight that executive compensation places on restructuring charges is lower than the weight on prerestructuring charge income. Previous research indicates that executive compensation positively weights earnings. Therefore, the relative weight on restructuring charges may fall into one of three categories: (i) no shielding, where the weight on restructuring charges is positive and at least as large as that on prerestructuring charge income; (ii) partial shielding, where the weight on restructuring charges is positive but smaller than that on prerestructuring charge income; and (iii) complete shielding, where the weight on restructuring charges is either zero or negative.

Two related tests of the intervention hypothesis are considered. The null in the first hypothesis is that executive compensation is not shielded from restructuring charges; the null in the second hypothesis is that executive compensation is completely shielded from restructuring charges. Stated in alternative form these hypotheses are:

- H1_{alt.}: Executive compensation is at least partially shielded from restructuring charges.
- H2_{alt.}: Executive compensation is not completely shielded from the impact of restructuring charges.

Hypotheses H1 and H2 are non-nested alternatives. Our testing procedure therefore faces four possible outcomes.⁵ First, if the null cannot be rejected for either H1 or H2, then our tests

aneous annual changes in firm value and restructuring charges. See also Elliott and Shaw (1988) and Strong and Meyer (1987).

⁵ This testing procedure is a special case of the Davidson and MacKinnon (1981) J-test for non-nested hypotheses. We start with two non-nested hypotheses, H1 and H2; H1 is rejected in favor of H2 when we both reject the null in H1 and fail to reject the null in H2. For more details, see Davidson and MacKinnon (1981) and Maddala (1988).

lack power, and we can make *no inferences* regarding the extent to which executive compensation is shielded from restructuring charges. Second, if the null is rejected for both H1 and H2, then our results indicate that executive compensation is *partially shielded* from restructuring charges. Third, if the null is rejected for H2 but not H1, then our results indicate that executive compensation is *not shielded* from restructuring charges. Fourth, if the null is rejected for H1 but not H2, then our results indicate that executive compensation is *completely shielded* from restructuring charges.⁶

Finally, our empirical analysis focuses exclusively on the compensation-earnings relation of the CEO. The CEO has the overall responsibility for the performance of the firm and is therefore likely to play a key role in the decision to restructure the firm's operations. We focus on the CEO because the extent to which other executives influence the restructuring is uncertain. Moreover, focusing on the CEO facilitates the comparison of our results with existing research.

III. Sample Description

Our sample selection procedure is outlined in table 1. We obtain an initial sample of restructuring charges by searching the National Automated Accounting Research System (NAARS) using the string "restruct!" This database carries the financial statements of more than 4,000 firms per year and at the time of the search covered fiscal years from 1982 to 1989. We restrict the search to income statements and only include restructuring charges that are identified as separate line items on their firms' income statements. This procedure enables us to collect the amount of the restructuring charge directly from the firms' income statements. The search is limited to the top 500 industrial and service firms, as listed in the 1990 *Fortune* 500 survey. This restricts the sample to large public corporations and facilitates the collection of the remaining firm-specific and CEO-specific data.⁷ The NAARS search provides us with an initial sample of 153 firms that report at least one restructuring charge.

Financial statement data are obtained from the COMPUSTAT annual industrial files with supplements from NAARS for missing data. Missing financial statement data reduces our sample to 146 firms reporting 270 separate annual restructuring charges. A further eight firms are eliminated from the sample because the charges relate to financial restructurings rather than asset restructurings. COMPUSTAT does not report restructuring charges separately but instead includes them with a variety of other gains and losses under the category special items (COMPUSTAT annual data item #17). We therefore collect the dollar amounts for all the annual restructuring charges directly from the firms' income statements. During years in which no restructuring charge is identified separately in a firm's income statement, we assign a restructuring charge of zero. Data on CEO cash compensation are initially collected from the *Forbes* annual CEO compensation surveys. These surveys list the annual cash compensation, as reported in the firm's proxy statement, for the CEO of each of the firms in at least one of the *Forbes* 500 rankings for that year. When a CEO is not included in the *Forbes* survey for a particular year, the CEO's cash compensation is manually collected from the appropriate proxy statement. We include CEO cash compensation data for all available CEO-years from 1970 (the first year that *Forbes*

⁶The null hypothesis in H2 does not rule out the possibility that executives are rewarded for taking restructurings. Brickley and Van Drunen (1990) find evidence of a small increase in firm value around the announcement of restructurings. A negative weight on restructuring charges is therefore consistent with the compensation committee rewarding value-enhancing restructurings.

⁷We initially obtain CEO cash compensation data from the annual surveys published by *Forbes*. The *Forbes* surveys list the annual cash compensation of the CEOs of firms in one of the four *Forbes* 500 rankings. NAARS identifies firms that are listed in the *Fortune* 500 rankings but not in the *Forbes* 500 rankings. However, there is major overlap between the firms listed in these two sets of rankings.

Table 1
Selection of the Sample of Firms Reporting Restructuring
Charges between 1982 and 1989

	<i>Number of Firms</i>
Search of the NAARS tape using the string "restruct!"	153
Less firms:	
(i) with restructuring charges relating to financial rather than asset restructurings	8
(ii) with insufficient financial statement data	7
(iii) with insufficient compensation data	31 <u>46</u>
Number of firms in final sample	<u><u>91</u></u>

conducted a compensation survey) to 1989 for each of these firms. Since we are primarily interested in the cash compensation awarded to the CEOs under annual incentive plans, we do not collect data on other components of CEO compensation (e.g., pension benefits, stock options). Finally, since our empirical work is based on a time-series analysis of the relation between cash compensation and earnings, we remove firms with less than a ten-year time-series of compensation data. This reduces the final sample to 91 firms reporting a total of 182 restructuring charges.

Table 2 reports the distribution of the restructuring charges over time, by industry and by firm. Asset restructuring increased in popularity in the mid-1980s but does not appear to be clustered in any particular year. Panel B reports the distribution of restructurings by SIC code. The restructuring charges are concentrated in two-digit SIC codes between 28 and 38, indicating that our sample is dominated by firms engaged in the manufacturing of durables. Panel C lists the number of annual restructuring charges reported by each of the sample firms between 1982 and 1989. Approximately one-half of the firms in the sample report only one restructuring charge. However, two firms, Control Data Corporation and Manville Corporation, each report six annual restructuring charges during the eight-year sample period.

Tables 3 and 4 provide additional descriptive evidence that facilitates interpretation of the empirical results presented in the next section. Table 3 summarizes the performance measures specified in the firms' formal annual executive incentive plans. Under federal securities laws, public corporations are required to provide a brief description of their top executive compensation plans in their annual proxy statements. The information in table 3 is obtained from the proxy statements issued by the sample firms in the year following the reporting of a restructuring charge. The proxy statement issued in this year describes the incentive plan(s) used to establish executives' annual incentive awards for the previous year.⁸ In some cases, the proxy referred to

⁸ We use the proxy statement in the year of the last restructuring for firms reporting multiple restructurings during the sample period.

Table 2
Distribution of Restructuring Charges over Time, by Industry and by Firm

Panel A: Distribution of restructuring charges by fiscal year

<i>Year</i>	<i>1982</i>	<i>1983</i>	<i>1984</i>	<i>1985</i>	<i>1986</i>	<i>1987</i>	<i>1988</i>	<i>1989</i>	<i>Total</i>
Number of restructuring charges	8	5	23	32	38	33	24	19	<u>182</u>

Panel B: Distribution of restructuring charges across two digit SIC codes

<i>Industry</i>	<i>SIC Code</i>	<i>Number of Observations</i>
Oil & gas extraction	13	1
Mining, quarry nonmetal minerals	14	3
Heavy construction—not building construction	16	1
Food & kindred products	20	7
Tobacco products	21	3
Textile mill products	22	1
Furniture and fixtures	25	1
Paper & allied products	26	6
Chemical & allied products	28	21
Petroleum refining & related industries	29	9
Rubber & miscellaneous plastic products	30	5
Stone, clay, and glass products	32	21
Primary metal industries	33	9
Fabricated metal, excluding machinery	34	5
Machinery	35	33
Electric & electric supplies	36	18
Transportation equipment	37	15
Measuring & photographic goods	38	12
Miscellaneous manufacturing industries	39	1
Transportation services	47	1
Communications	48	1
Nondurable goods—wholesale	51	3
Apparel and accessory stores	56	1
Auto repair, services, and parking	75	1
Engineering, accounting, & related services	87	<u>3</u>
Total		<u>182</u>

Panel C: Number of restructuring charges reported per firm

<i>Restructuring charges per firm</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>Total</i>
Number of firms	46	19	14	6	4	2	<u>91</u>

Table 3
The Performance Measures Used in Executives' Annual Incentive Plans for 91 Firms
Reporting 182 Restructuring Charges from 1982 through 1989

<i>Measure</i>	<i>Number of Observations</i>	<i>Percentage of Firms Using the Measure</i>
Earnings-based measures:		
Net income	24	26%
Pretax earnings	21	23
Return on shareholders' equity	6	7
Earnings-per-share	6	7
Net income before extraordinary items	3	3
Net income before nonrecurring items	2	2
Return on assets	2	2
Return on investment	1	1
Other measures:		
Cash flows	5	5
Sales	2	2
Cash dividends	1	1
Discretionary (i.e., business performance measured informally)	10	11
Performance measure not specified	17	19

Note: Plan details obtained from proxy statements filed with the SEC.

an incentive compensation plan that had been approved in an earlier year. In these cases, we obtained the information from the description of the plan provided in the proxy statement for the earlier year. The number of performance measures listed in table 3 exceeds the number of firms in our sample because some firms use more than one performance measure in their annual incentive plan.

The listing of performance measures establishes two key features of the annual incentive plans in our sample. First, the majority of these plans use earnings-based performance measures. Earnings-based measures are employed by 71 percent of the firms. Of the remaining firms, 11 percent leave the determination of incentive awards entirely to the discretion of the board of directors, and 17 percent do not disclose their performance measure(s). Only one of the firms that explicitly identifies a performance measure does not use earnings performance. The second key feature is that none of the earnings-based performance measures explicitly provides for the removal of the effect of restructuring charges. In fact, there are only two cases that explicitly include adjusting earnings for nonrecurring items. In these two cases, the task of identifying

Table 4
The Number and Type of Explanations Provided for the Restructuring Charges; 182 Restructuring Charges from 1982 through 1989

<i>Panel A: Number of explanations reported in the financial statements</i>							
Explanations reported	0	1	2	3	4	5	Total
Number of restructuring charges	14	36	70	48	8	6	<u>182</u>
<i>Panel B: Explanations for the restructuring charges</i>							
	<i>Number of Observations</i>		<i>Percentage</i>				
Workforce reductions	89		49				
Reconfiguration of operations	89		49				
Divestitures	66		36				
Writedown or writeoff of assets	57		31				
Plant closures	52		29				
Discontinuation of operations	27		15				
Specific reasons not outlined	16		9				

Note: Restructuring charge explanations obtained from annual reports.

nonrecurring items is assigned to the compensation committee. This is illustrated in the 1988 Incentive Compensation Plan of Allied Signal:

Consolidated Earnings is defined to omit the effects of nonrecurring items, extraordinary items and discontinued operations and to allow other adjustments deemed appropriate by the Board or its Compensation Committee.

Moreover, many of the plans incorporate a feature similar to the Allied Signal provision allowing the compensation committee to make other adjustments as it deems appropriate.

In sum, the evidence in table 3 indicates that in the majority of cases, strict adherence to the definition of earnings specified in the sample firms' annual incentive plans would expose executive compensation to restructuring charges. Further, in the two isolated cases where provisions are made to shield executive compensation from nonrecurring items, implementation of these provisions is left to the discretion of the compensation committee.

Table 4 summarizes the explanations provided in the firms' financial statements for taking the restructuring charges. These explanations provide insights into the extent to which the restructuring charges reflect real operating decisions made with the objective of improving future firm performance (e.g., eliminating unprofitable plants) as opposed to accounting policy decisions alone (e.g., asset writedowns). It is likely that the compensation committee will consider it more important to shield executive compensation from restructuring charges relating to real operating decisions than to those relating to cosmetic accounting writedowns. Panel A of

Table 5
Descriptive Statistics on 182 Restructuring Charges Reported
between 1982 through 1989

<i>Variable</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Lower Quartile</i>	<i>Median</i>	<i>Upper Quartile</i>
COMP (\$Thous.)	881	421	545	802	1120
Assets (\$Mill.)	7479	11815	1377	2728	7499
Market Value (\$Mill.)	4104	7120	786	1421	3898
R_CHARGE (\$Mill.)	-176	381	-183	-57	-17
INCOME (\$Mill.)	374	1047	-10	101	433
ADJ_INC (\$Mill.)	550	1069	45	169	593
<u>R_CHARGE</u>	-0.036	0.055	-0.050	-0.017	-0.007
Assets					
<u>R_CHARGE</u>	-0.095	0.237	-0.082	-0.029	-0.011
Market Value					
<u>R_CHARGE</u>	-0.795	1.860	-0.560	-0.195	-0.067
ADJ_INC					

Notes: All dollar amounts are CPI adjusted to 1989 equivalent dollars.

COMP is the CEO's annual cash compensation.

R_CHARGE is the restructuring charge.

INCOME is income before tax, extraordinary items and discontinued operations.

ADJ_INC is prerestructuring charge income, computed as INCOME - R_CHARGE.

Descriptive statistics on $\frac{R\_CHARGE}{ADJ\_INC}$ exclude 26 cases where ADJ_INC is negative.

table 4 indicates that the majority of firms provide multiple explanations, with two-thirds of the sample reporting more than one explanation for each restructuring charge. Panel B indicates that the most prevalent reasons for the restructuring charges are workforce reductions (49 percent), reconfiguration of operations (49 percent), and divestitures (36 percent). While 31 percent of our restructurings involve asset writedowns, there are no cases where the restructuring consisted of a writedown alone. This suggests that the restructuring charges in our sample are primarily the result of management making significant changes to their firm's operations, as opposed to passively writing down the value of assets.

Descriptive statistics for the sample during years in which a restructuring charge is taken are presented in table 5. This table provides evidence on the magnitude of the impact of the restructuring charges on the sample firms' financial statements. All dollar values are converted into 1989 dollars using a CPI adjustment. Our sample includes large firms, with total assets averaging almost \$8 billion and CEO cash compensation (COMP) averaging almost \$900,000. Income is measured using pretax earnings (INCOME). This measure is directly comparable to the restructuring charges (R_CHARGE), as both are reported on a pretax basis. In the empirical analysis, INCOME is decomposed into two components:

$$INCOME = ADJ\_INC + R\_CHARGE \quad (1)$$

ADJ_INC represents the firm's prerestructuring charge income. Restructuring charges are added to ADJ_INC, because we record them as negative numbers to reflect the fact that they reduce earnings. The average restructuring charge is -\$176 million, averaging 10 percent of the market value of equity and 80 percent of prerestructuring charge income.⁹

IV. Empirical Analysis

Existing research has documented a positive relation between CEO cash compensation and accounting earnings performance (Lambert and Larcker 1987).¹⁰ The intervention hypothesis predicts that CEO compensation places less positive weights on restructuring charges relative to the remaining components of INCOME. This leads to the following model:

$$\text{COMP}_i = \beta_0 + \beta_1 \text{ADJ\_INC}_i + \beta_2 \text{R\_CHARGE}_i + \varepsilon_i. \quad (2)$$

Consistent with previous research, we expect the coefficient on ADJ_INC to be positive. Our research hypotheses focus on the coefficient on R_CHARGE. Hypotheses 1 and 2 generate the following testable predictions:

$$\begin{aligned} H1_{\text{null}}: \beta_1 - \beta_2 &\leq 0 & \text{and} & & H1_{\text{alt.}}: \beta_1 - \beta_2 > 0 \\ H2_{\text{null}}: \beta_2 &\leq 0 & \text{and} & & H2_{\text{alt.}}: \beta_2 > 0 \end{aligned}$$

We estimate a separate regression model for each firm in the sample. This approach is taken because the evidence in Lambert and Larcker (1987) suggests that the regression parameters are relatively constant within a single firm over time but vary systematically in cross section. The firm-specific analysis requires the estimation of the compensation-earnings relation on a firm-by-firm basis. We employ all compensation and earnings data that we have available for the period from 1970 through 1989. This gives a maximum of 20 time-series observations for each firm. However, our NAARS search only identifies restructuring charges for the period from 1982 through 1989. This approach therefore imposes the additional assumptions that significant restructuring charges were not reported prior to 1982 and that the regression coefficients are stable over time. We select this approach because using the longer time-series of compensation and earnings data enhances the efficiency of estimation. Moreover, restructuring charges arose along with the restructuring of the U.S. manufacturing industry that began in the early eighties, and so we expect to encounter few restructuring charges prior to 1982. For example, the annual surveys in *Accounting Trends and Techniques* indicate that restructuring charges were the most frequently disclosed type of losses in 1986 and 1987, but the surveys do not even include restructuring charges in the list of disclosed losses for years prior to 1982. We also conducted robustness tests and verified that our inferences are not affected by the use of the 1970 to 1981 data.¹¹

Performing firm-specific regressions of equation (2) using ordinary least squares results in positively serially correlated residuals. We eliminate the residual dependence using the Cochrane-

⁹ The ratio of restructuring charge to prerestructuring charge income is not computed for 26 observations with negative prerestructuring charge income.

¹⁰ Existing research demonstrates that stock price performance is also a determinant of CEO cash compensation, though to a lesser extent than earnings (Lambert and Larcker 1987; Sloan 1993). To establish that stock price performance is not a correlated omitted variable in our analysis, we replicated our results with the inclusion of stock price performance as an additional explanatory variable in the regression model in equation (2). All inferences regarding the treatment of restructuring charges in setting executive compensation are identical to those reported in the paper.

¹¹ Two robustness tests were performed to establish that the results are not significantly affected by the inclusion of compensation data from the 1970 to 1981 period. First, we reestimated the results using a pooled cross-sectional and time-series research design using data from the 1982 to 1989 time period. Second, we included dummy variables to allow the

Orcutt method of quasi-first-differencing (see Maddala 1988, 1992). This provides us with a set of parameter estimates for each of the 91 firms in the sample after removing first-order serial correlation. Statistical inference is conducted by aggregating the t -statistics on the coefficients from the differenced firm-specific regressions. The t -statistics are aggregated to form a Z -statistic as follows:

$$Z = \frac{1}{\sqrt{N}} \sum_{j=1}^N \frac{t_j}{\sqrt{k_j/(k_j-2)}} / \sqrt{1 + (N-1)\bar{r}}, \quad (3)$$

where t_j = t -statistic for firm j ; k_j = degrees of freedom in regression for firm j ; N = number of firms in sample; and $\bar{r}$ = the mean correlation between the sample firms' t -statistics. Under the null hypothesis, Z is distributed asymptotically as a standard normal variate (Anderson 1971). The Z -statistics are computed under the assumption of independence (i.e., $\bar{r} = 0$). This assumption is supported by the lack of cross-sectional dependence among the regression residuals from the firm-specific regressions.¹²

The results of estimation of equation (2) are reported in table 6. The results indicate that the coefficient on ADJ_INC is positive and significant with a mean (median) value of 0.74 (0.50). This is consistent with previous research that has documented a positive association between compensation and income. The coefficient on R_CHARGE provides evidence concerning the impact of restructuring charges on executive compensation. A positive coefficient indicates that compensation is not completely shielded from restructuring charges and that such charges reduce compensation while a coefficient of zero indicates that compensation is completely shielded from restructuring charges. The coefficient on R_CHARGE is negative and significant with a mean (median) value of -2.77 (-0.66). The negative coefficient indicates that executive compensation actually increases as restructuring charges increase. One explanation for this result is that additional compensation is required to offset CEOs' reluctance to restructure their firms. While restructurings may increase shareholder value, they typically involve reducing firm size and laying off employees, and it is likely that these actions do not receive positive weights in most CEOs' utility functions.

Table 7 reports the statistical tests of hypotheses H1 and H2. Both tests are one-tailed and the Z -statistic is reported along with its associated significance level. Hypothesis $H1_{null}$ is rejected in favor of $H1_{alt}$ ($Z = 9.72$), indicating that CEO compensation is less sensitive to restructuring charges than to other components of income. This is consistent with intervention by compensation committees to at least partially shield executives' cash compensation from restructuring charges. Hypothesis $H2_{null}$ is *not* rejected in favor of the $H2_{alt}$. That is, the hypothesis that restructuring charges are completely filtered from CEO compensation is not rejected. In fact, the sample Z -statistic is negative ($Z = -6.27$), so there is no support for the alternative hypothesis that the coefficient on R_CHARGE is greater than zero. The combined results indicate that CEO compensation is *completely* shielded from restructuring charges. The negative coefficient on R_CHARGE and the large negative associated Z -statistic suggest that CEO compensation increases as a result of the restructurings.¹³

coefficients, β_0 and β_1 , from the firm-specific regression model in equation (2) to change between the time periods from 1970 to 1981 and 1982 to 1989. For the details regarding this technique, see Maddala (1988, 263). In both tests, inferences regarding the treatment of restructuring charges in setting executive compensation are identical to those reported in the paper.

¹² We estimated the pair-wise correlations between the residuals for 63 firms in our sample having a complete time-series of data from 1970 to 1989. The mean correlation is 0.063, suggesting that cross-sectional dependence is not a serious problem in our data.

¹³ One potential omitted variable from our analysis is earnings performance. The compensation-earnings relation is

Table 6

Descriptive Statistics from Firm-Specific Regressions of CEO Cash Compensation on Income and Restructuring Charges. There are 91 Firm-Specific Regressions, with each Regression Having between 10 and 20 Annual Observations from 1970 to 1989

$$\text{COMP}_t = \beta_0 + \beta_1 \text{ADJ\_INC}_t + \beta_2 \text{R\_CHARGE}_t + \varepsilon_t$$

	Mean	Z-Statistic	Lower Quartile	Median	Upper Quartile
$\hat{\beta}_0$	689.70	—	451.94	626.48	930.07
$\hat{\beta}_1$	0.74	18.89**	0.04	0.50	1.24
$\hat{\beta}_2$	-2.77	-6.27**	-3.49	-0.66	0.37
Differencing coefficient	-0.32	—	-0.50	-0.34	-0.19
Adjusted R ²	0.30	—	0.03	0.26	0.55
Number of observations	18.31	—	18	20	20

Notes: Regressions are run using the method of generalized first-differences to correct for serial correlation. The differencing coefficient is obtained via a single iteration of the Cochrane-Orcutt procedure.

COMP is CEO cash compensation;

INCOME is pretax income;

R_CHARGE is the restructuring charge; and

ADJ_INC is INCOME - R_CHARGE.

** Significant at the 0.01 level, two-tailed test.

The results in table 7 allow us to assess the statistical significance of hypotheses H1 and H2 but are silent on the question of economic significance. The economic significance of the results can be gauged by computing the incremental dollar effect on CEO compensation of assuming cash compensation is not shielded from restructuring charges. The compensation-earnings relation for each firm is estimated using the model in equation (2). The method of quasi first-differencing is applied to each regression to control for serial correlation in the regression residuals. The estimated parameters from these regressions are then used to generate prediction errors in years during which a restructuring charge is taken:

$$\hat{\varepsilon}_t = \text{COMP}_t - \widehat{\text{COMP}}_t$$

where

$$\widehat{\text{COMP}}_t = \hat{\beta}_0 + \hat{\beta}_1 \text{INCOME}_t$$

and INCOME denotes reported income inclusive of restructuring charges. The prediction errors provide an estimate of the decline in CEO compensation absent shielding from restructuring charges. The results in table 8 indicate that CEO compensation would have been, on average, \$46,040 lower in restructuring years without shielding. This corresponds to approximately 6

is expected to be flat for poorly performing firms. Since firms reporting restructurings are often poor performers, we sought to ascertain that the lack of a compensation-performance relation for poorly performing firms was not influencing our results. We therefore replicated our analysis after excluding 26 firms with negative prerestructuring charge income in restructuring years. The results obtained after excluding these firms are consistent with those reported in the paper.

Table 7

Tests of Hypotheses Concerning the Relation between CEO Cash Compensation and Restructuring Charges. Z-statistics are Formed by Aggregating 91 Firm-Specific t-statistics.

$$\text{COMP}_t = \beta_0 + \beta_1 \text{ADJ\_INC}_t + \beta_2 \text{R\_CHARGE}_t + \varepsilon_t$$

<i>Hypothesis</i>	<i>Z-statistic</i>	<i>Significance Level</i>
H1 _{null} : $\beta_1 - \beta_2 \leq 0$ versus	9.72	0.000
H1 _{alt} : $\beta_1 - \beta_2 > 0$		
H2 _{null} : $\beta_2 \leq 0$ versus	-6.27	1.000
H2 _{alt} : $\beta_2 > 0$		

Note: The significance level associated with the reported Z-statistic denotes the probability that the null hypothesis would be incorrectly rejected if the reported value of Z were used as the critical test value.

percent of the CEO's cash compensation, and might well have provided disincentives for CEOs to take restructurings, had intervention not taken place.

The evidence presented thus far suggests that, on average, the compensation committee intervenes to shield executive compensation from restructuring charges.¹⁴ We next investigate characteristics that are likely to determine the extent of intervention. To do this, we first require a measure of the extent to which compensation is shielded from restructuring charges. The measure we use is $\hat{\beta}_2$, the estimated coefficient on R_CHARGE from the regression model in equation (2). This coefficient measures the sensitivity of CEO compensation to restructuring charges. In the absence of intervention, we expect β_2 to be positive. Intervention by the compensation committee to shield executive compensation from restructuring charges will reduce β_2 . β_2 is therefore inversely proportional to the degree of shielding. The cross-sectional predictions are tested by regressing each firm's $\hat{\beta}_2$ on the hypothesized cross-sectional determinants. As firms report more than one restructuring charge, the dependent variable for each firm i , β_{2i} , can appear more than once. A negative coefficient on a determinant indicates that the degree of shielding is increasing in that determinant.

Three factors are posited to explain cross-sectional variation in β_2 . The first is the anticipated contribution of the restructuring charge to the long-term well-being of the firm. However, because this is not observable, we instead measure the long-term value as perceived by the stock-market (RETURN). This is measured as the difference between the contemporaneous annual with-dividend stock return and the corresponding return on the CRSP value-weighted index in the year

¹⁴ We reinforced this interpretation of our results by surveying two directors who sit on the compensation committees of several *Fortune* 500 firms (including one firm in our sample). Both directors confirmed that they had experienced cases in which the compensation committee actively intervened to remove the impact of restructuring charges from CEOs' earnings-based incentive compensation. One director elaborated by emphasizing that such action was not automatic and that intervention only took place when the compensation committee "firmly believed restructuring provided long-term benefits, and the CEO should be praised rather than censured for taking on the restructuring."

Table 8

Descriptive Statistics on the Estimated Amount by which CEO Cash Compensation would have been Reduced if it were not Shielded from Restructuring Charges. Sample Consists of 182 Restructuring Charges made by 91 Firms between 1982 and 1989

<i>Variable</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Lower Quartile</i>	<i>Median</i>	<i>Upper Quartile</i>
Estimated reduction (\$000s)	46.04	118.13	0.35	24.50	75.36
Estimated reduction as a percentage of lagged compensation	5.86%	14.80	0.59	3.05	9.73

Note: The reduction is estimated by deducting realized compensation in restructuring years (COMP) from estimated compensation in restructuring years ($\widehat{\text{COMP}}$). Estimated compensation is computed as $\widehat{\text{COMP}}_i = \hat{\beta}_0 + \hat{\beta}_1 \text{INCOME}_i$ where $\hat{\beta}_0$ and $\hat{\beta}_1$ are obtained by estimating firm specific regressions of the model: $\text{COMP}_i = \beta_0 + \beta_1 \text{ADJ\_INC}_i + \beta_2 \text{R\_CHARGE}_i + \varepsilon_i$.

of the restructuring charge.¹⁵ The second factor is the frequency with which restructuring charges are incurred (NUMBER). This is measured as the number of years in which the firm reported a restructuring charge over the sample period. We predict that when restructuring charges are taken routinely, they are more likely to contain ongoing operating costs that are controllable by management. Therefore, executive compensation is more likely to be shielded when restructuring charges are nonrecurring. The third factor is the executive's expected horizon with the firm (TENURE). If the executive has a long expected horizon with the firm, then the executive will trade-off the short-term impact of the restructuring charge on earnings against the long-run benefits of the restructuring. Thus, the stockholders' and executive's interests will be relatively well aligned. However, if the executive has a short expected horizon with the firm, then the executive will be more concerned with the short-term decrease in earnings. The compensation committee is therefore predicted to be more likely to filter restructuring charges from the compensation of executives with relatively short expected horizons with their firms. TENURE is measured as the number of years the CEO has been in office.¹⁶

¹⁵ An alternative approach would be to use the stock return at the announcement of the restructuring. We examined the *Wall Street Journal Index* for a subsample of our restructurings to evaluate the feasibility of identifying announcements relating to the restructurings. This approach was not adopted in the paper because it involved too many judgment calls.

¹⁶ The number of years the CEO subsequently remained in office was also considered as a proxy for expected horizon with the firm. However, this proxy was not used, since many of the CEOs in our sample had not left their positions as of the end of the sample period.

Table 9

Weighted Least Squares Estimates from a Regression Model of the Determinants of the Degree to which Executive Compensation is Shielded from Restructuring Charges; 182 Firm-year Observations in which Restructuring Charges are Reported between 1982 and 1989

<i>Independent Variable</i>	<i>Intercept (t-statistic)</i>	<i>TENURE (t-statistic)</i>	<i>RETURN (t-statistic)</i>	<i>NUMBER (t-statistic)</i>	<i>Adjusted R²</i>
Predicted sign		-	-	+	
	-0.17 (-1.12)	-0.03 (-2.69)**	-0.06 (-0.49)	0.08 (2.07)*	0.04

Note: The regression model estimated is:

$$\hat{\beta}_{2i} = \gamma_0 + \gamma_1 \text{TENURE}_i + \gamma_2 \text{RETURN}_i + \gamma_3 \text{NUMBER}_i + e_i,$$

where $\hat{\beta}_{2i}$ is the estimated coefficient from the following firm-specific regression model:

$$\text{COMP}_i = \beta_0 + \beta_1 \text{ADJ\_INC}_i + \beta_2 \text{R\_CHARGE}_i + \varepsilon_i$$

The regression weights are the reciprocals of the variances of the individual firms' β_2 estimates.

COMP denotes CEO cash compensation;

R_CHARGE denotes restructuring charge;

ADJ_INC denotes prerestructuring charge income;

TENURE denotes the number of years the CEO has been in office in the year of restructuring charge i ;

RETURN denotes the market-adjusted stock return in the year of restructuring charge i ; and

NUMBER denotes the number of restructuring charges taken by the firm reporting restructuring charge i between 1982 and 1989.

* Significant at the 0.05 level, two-tailed test.

** Significant at the 0.01 level, two-tailed test.

Results from a weighted least squares cross-sectional regression are presented in table 9.¹⁷ The coefficient on RETURN has the predicted negative sign but is insignificantly different from zero. The insignificance of this coefficient may be due to the crudity of the empirical proxy. The annual stock return reflects many events and is a noisy measure of the expected long-term benefits of the restructuring. The coefficient on NUMBER is positive, as predicted, and statistically significant ($t = 2.07$). This confirms that executive compensation is shielded to a greater degree from nonrecurring restructuring charges. Finally, the coefficient on TENURE is negative and statistically significant ($t = -2.69$). This coefficient indicates that the longer the CEO has been in

¹⁷ An ordinary least squares regression employing the $\hat{\beta}_2$ coefficients from the first-pass firm-specific regressions as the dependent variable displays strongly heteroskedastic residuals and rejects White's (1980) specification test. The likely cause of this problem is that the variances of the individual firms' $\hat{\beta}_2$ s are not equal. As a consequence, the resulting parameter estimates are inefficient. To mitigate this problem, the reciprocals of the estimated $\hat{\beta}_2$ variances from the firm-specific regressions are used as weights in a weighted least squares regression of $\hat{\beta}_2$ on the determinants. The resulting regression reported, in table 9, displays considerably less heteroskedastic residuals, and White's (1980) test does not reject homoskedasticity at conventional significance levels.

office, the more likely that the restructuring charge will be filtered from the CEO's compensation.¹⁸

V. Conclusions

This paper investigates the hypothesis that the compensation committee actively intervenes in setting executives' earnings-based cash compensation. We argue that restructuring charges provide a powerful test of this hypothesis because the decision to restructure a company's operations has widely diverging effects on firm value and short-term earnings. Our results are consistent with intervention by the compensation committee to shield executive compensation from restructuring charges. We find that restructuring charges are not contractually excluded from the measures of earnings performance specified in annual incentive plans. However, our empirical analysis indicates that, on average, CEO cash compensation is shielded from restructuring charges. We also find that CEO compensation is more likely to be shielded from restructuring charges when the restructuring charges are nonrecurring and the CEO has a shorter expected horizon with the firm.

The study has a number of limitations. First, our sample is potentially biased in that, by construction, it consists only of firms reporting restructuring charges. The degree of intervention documented in our sample could overstate the case for the population of firms, which includes firms that have not reported restructuring charges. Nevertheless, it should be noted that many firms have reported restructuring charges, and our sample itself consists of almost one-fifth of the firms in *Fortune* 500. A second limitation of our study is that the evidence is restricted to restructuring charges and cannot be readily generalized to other components of earnings. For example, the accounting practice of immediately expensing R&D expenditures can provide executives with incentives to underinvest in this area (Dechow and Sloan 1991). However, our analysis does not provide direct evidence on whether compensation committees intervene to shield executives from such expenditures. Furthermore, our analysis focuses exclusively on losses, where intervention by the committee increases executive compensation. The committee may behave quite differently in the case of gains, where intervention by the committee would reduce CEO compensation. Nevertheless, in the case of restructuring charges, the thesis that earnings-based performance measures are mechanically applied is rejected. It remains for future research to document the full scope of intervention by the compensation committee.

¹⁸ We also considered two alternative specifications of the cross-sectional regression equation. In the first, we measure the dependent variable (extent of shielding) as $\left[\frac{\hat{\beta}_1 - \hat{\beta}_2}{\hat{\beta}_1} \right]$. In the second, we include $\hat{\beta}_1$ as an additional explanatory variable. These alternative specifications confirmed the inferences from the initial specification. In particular, the coefficient on NUMBER is consistently significant and of the hypothesized sign, the coefficient on TENURE is consistently significant and of the hypothesized sign, and the coefficient on RETURN is consistently of the hypothesized sign but statistically insignificant.

References

- Abdel-khalik, A. R. 1985. The effect of LIFO-switching and firm ownership on executives' pay. *Journal of Accounting Research* 23 (Autumn): 427-47.
- _____, C. Chi, and D. Ghicas. 1987. Rationality of executive compensation schemes and real accounting changes. *Contemporary Accounting Research* 4 (Fall): 32-60.
- Accounting Principles Board Opinion No. 30. 1973. *Reporting the results of operations—Reporting the effects of disposal of a segment of a business, and extraordinary, unusual and infrequently occurring events and transactions*. New York: American Institute of Certified Public Accountants, Inc.

- Anderson, T. W. 1971. *The Statistical Analysis of Time-Series*. New York: Wiley.
- Brickley, J. A., and L. D. Van Drunen. 1990. Internal corporate restructurings: An empirical analysis. *Journal of Accounting and Economics* 12 (January): 251-80.
- The Conference Board. 1982. *Corporate Directorship Practices: The Compensation Committee*. New York: The Conference Board.
- _____. 1990. *Top executive compensation: 1990 Edition*. New York: The Conference Board.
- Davidson, R., and J. MacKinnon. 1981. Several tests for model specification in the presence of alternative hypotheses. *Econometrica* 49 (May): 781-93.
- Dechow, P. M., and R. G. Sloan. 1991. Executive incentives and the horizon problem: An empirical investigation. *Journal of Accounting and Economics* 14 (March): 51-89.
- Defeo, V. J., R. A. Lambert, and D. F. Larcker. 1989. The executive compensation effects of equity-for-debt swaps. *The Accounting Review* 64 (April): 201-27.
- Earle, A. F. 1989. Compensating chief executive officers. *Business Quarterly* (Winter): 32-37.
- Elliott, J. A., and W. H. Shaw. 1988. Write-offs as accounting procedures to manage perceptions. *Journal of Accounting Research* 26 (Supplement): 91-119.
- Fox, H. 1979. *Top Executive Bonus Plans. Conference Board Report no. 760*. New York: The Conference Board.
- Gaver J., K. Gaver, and J. Austin. 1993. Additional evidence on the association between Income Management and earnings-based bonus plans. Working paper, University of Georgia, Athens.
- Healy, P. M. 1983. The impact of bonus schemes on accounting choices. Ph.D. dissertation, University of Rochester, Rochester.
- _____. 1985. The effect of bonus schemes on accounting decisions. *Journal of Accounting and Economics* 7 (April): 85-107.
- _____, S. Kang, and K. G. Palepu. 1987. The effects of accounting procedure changes on CEOs' cash salary and bonus compensation. *Journal of Accounting and Economics* 9 (January): 7-34.
- Holthausen, R., D. F. Larcker, and R. G. Sloan. 1993. Annual bonus schemes and the manipulation of earnings. Working paper, University of Pennsylvania, Philadelphia.
- Kaplan, R., and A. Atkinson. 1989. *Advanced Management Accounting*. Englewood Cliffs, NJ: Prentice Hall.
- Lambert, R. A., and D. F. Larcker. 1987. An analysis of the use of accounting and market measures of performance in executive compensation contracts. *Journal of Accounting Research* 25 (Supplement): 85-125.
- Maddala, G. S. 1988. *Introduction to Econometrics*. New York: Macmillan.
- Merchant, K. 1989. *Rewarding results: Motivating profit center managers*. Boston, MA: Harvard Business School Press.
- Pearson, M. W., and L. L. Okubara. 1987. Restructurings and impairment of value: A growing controversy. *Accounting Horizons* 1 (March): 35-41.
- Rappaport, A. 1990. The staying power of the public corporation. *Harvard Business Review* 90 (January-February): 96-104.
- Securities and Exchange Commission. 1982. *Analysis of Results of 1981 Proxy Statement Disclosure Monitoring Program*. Washington, DC: Securities and Exchange Commission.
- _____. 1986. Interpretations regarding restructuring charges. *Staff Accounting Bulletin No. 67*. Washington, DC: Securities and Exchange Commission.
- Sibson and Company. 1991. *Trends and Issues in Rewarding Executive Performance*. Princeton, NJ: Sibson and Company.
- Sloan, R. G. 1993. Accounting earnings and top executive compensation. *Journal of Accounting and Economics* 16 (January/April/July): 55-100.
- Strong, J. S., and J. Meyer. 1987. Asset writedowns: Managerial incentives and security returns. *Journal of Finance* 42 (July): 643-63.
- Watts, R., and J. Zimmerman. 1986. *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice Hall.
- White, H. 1980. A heteroskedasticity consistent covariance matrix estimator and a direct test of heteroskedasticity. *Econometrica* 48 (May): 817-38.

The Effects of Instruction and Experience on the Acquisition of Auditing Knowledge

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SYNOPSIS AND INTRODUCTION: Libby (1993) suggests a simple model of the acquisition of expertise where knowledge and ability determine performance, and instruction, experience, and ability determine the acquisition of knowledge. An important implication of the model is that a detailed understanding of the knowledge acquisition process is needed before the practical implications of expertise research are evident (see also Bonner and Pennington 1991; Waller and Felix 1984). Libby's review indicates, however, that the vast majority of studies of the knowledge acquisition process focus on what knowledge auditors acquire during a particular period of time with the firm, but not on what particular aspects of instruction and experience lead to superior knowledge.¹ The latter type of study is necessary before firms can determine how best to organize auditors' training and experiences to allow efficient and effective acquisition of the necessary knowledge.

The importance of analytical procedures in auditing and the popularity of ratio analysis as an analytical procedure are well-documented (e.g., Biggs and Wild 1984; Libby 1985). The current study focuses on the knowledge necessary to perform ratio analysis in audit planning. Specifically, we examine the effectiveness of various combinations of instruction and experience (practice and feedback) in producing this knowledge. The results indicate that combinations of instruction and no experience or of instruction and practice without feedback do not produce knowledge. Practice with explanatory feedback and any form of instruction creates

¹Two exceptions relate to the specific effects of instruction and experience on the acquisition of frequency knowledge (Butt 1988; Nelson 1993), which has characteristics that do not generalize to most types of knowledge required in auditing. For example, acquisition of frequency knowledge requires less effort than acquisition of other types of knowledge.

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gains in knowledge, but may not always be available in the audit environment. Practice with outcome feedback, on the other hand, does not assist in the acquisition of knowledge *unless* it is preceded by instruction with what we have labeled "understanding rules," making this combination appear to be an adequate substitute for explanatory feedback. Practice with outcome feedback combined with what we call "how-to rules" does not promote knowledge acquisition. Finally, results indicate that ability aids in the acquisition of knowledge, and that this knowledge is related to performance in ratio analysis.

These findings have implications for audit effectiveness and efficiency, and for education and firm training related to ratio analysis. If explanatory feedback can be replaced by a combination of understanding rules and practice with outcome feedback, audit efficiency could be increased since explanatory feedback takes more time and more experienced personnel. Explanatory feedback may also be inaccurate or unavailable, particularly under conditions of time pressure. However, if only outcome feedback is to be provided for ratio analysis, understanding rules must be incorporated into education and training. For the most part, firm training and university education currently provide only how-to rules for ratio analysis (see Bonner and Pennington 1991; Ernst & Whinney 1986). The ideas described above could also be extended to tasks other than ratio analysis for which outcome feedback is available (Solomon and Shields 1993).

Key Words: *Knowledge acquisition, Instruction, Experience, Ratio analysis.*

Data Availability: *Data are available from the first author upon request.*

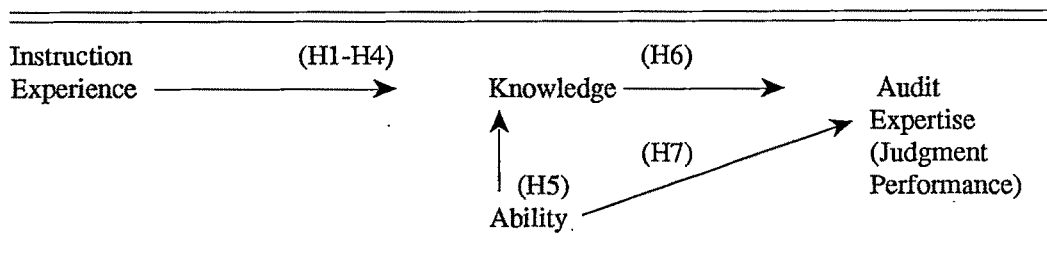
THE remainder of this paper is organized as follows. The first section reviews the literature on the effects of instruction and experience on knowledge acquisition, and develops hypotheses. The effects of abilities on knowledge acquisition, as well as the effects of knowledge and abilities on performance, are also discussed to examine the other links in Libby's (1993) model. The second section describes the method, and the third section presents the results. The final section discusses the results and presents some directions for future research.

I. Literature Review and Hypothesis Development

According to Libby's (1993) model, auditors acquire knowledge primarily through instruction and experience (see figure 1). Instruction may be received both formally and informally in college and through firm continuing education courses, and varies in length, content, and style. Individuals also might learn from practice in performing tasks and receiving feedback on their judgments. Feedback in auditing comes from reviewers and the environment (Bonner and Pennington 1991; Solomon 1987; Solomon and Shields 1993); again, the quantity and quality of practice and feedback varies. Both practice and feedback are considered part of "experience." In this study, we focus on the acquisition of knowledge through various combinations of instruction and experience.

Several theories of knowledge acquisition make a useful distinction between declarative knowledge and procedural knowledge, both of which may be important to performance in skilled tasks like ratio analysis (e.g., Anderson 1982; Winograd 1975). Declarative knowledge is knowledge of facts and definitions. For example, cash is part of current assets; this knowledge is necessary in ratio analysis because current assets is an element in some ratios. Procedural knowledge consists of rules or steps needed for performing skilled tasks. An example rule for ratio

Figure 1
Libby's (1993) Model of the Acquisition of Audit Expertise
and Hypotheses Addressing Each Relation



analysis would be one stating that: "if the gross margin ratio is overstated, consider errors which understate sales, overstate gross margin, or overstate both sales and gross margin by the same amount." Another useful way of thinking about this distinction is that declarative knowledge is similar to data, and procedural knowledge is similar to processes (Rumelhart and Norman 1981; Waller and Felix 1984). As a consequence, declarative knowledge generally must be in place prior to the acquisition of procedural knowledge, so that procedural knowledge can be compiled through interpreting declarative knowledge (Anderson 1982). In auditing, basic declarative knowledge is commonly acquired through formal education, and procedural knowledge is acquired later during one's professional career (Waller and Felix 1984). Therefore, in this study, we focus on the acquisition of procedural knowledge.

Effects of Instruction and Experience on Procedural Knowledge Acquisition

Instruction. Although instruction is not normally considered adequate to create procedural knowledge, the psychology literature has examined whether certain types of instruction can promote knowledge acquisition. Two types of instruction frequently examined are "how-to rules" and "understanding rules." "How-to rules" consist of lists of steps or procedures to be followed in performing a task; these rules contain little explanation. For example, an audit program might state: "foot the sales journal." "Understanding rules," on the other hand, provide explanations with the steps and, possibly, information about why the steps are performed, how they relate to each other, and so forth. Audit planning workpapers in which audit program steps are derived from risk analyses and audit objectives might provide such information (see, e.g., Arens and Loebbecke 1991, 391).

The effects of how-to rules and understanding rules on procedural knowledge acquisition are unclear for two reasons. First, studies have used performance as a proxy for procedural knowledge; however, performance differences could be due to differences in declarative knowledge or abilities. Second, results are mixed and limited to a few domains, mostly mathematics. Examining how-to rules, Post and Brennan (1976) found that providing geometry students with a list of procedures on how to do geometry proofs did not improve problem-solving performance. On the other hand, LeFevre and Dixon's (1986) results indicated that subjects did as well at series classification problems with how-to rules as with examples. In this study, performance was relatively poor in both groups and no measure of knowledge or performance was made prior to the use of instruction, so it is not clear whether how-to rules promoted procedural knowledge acquisition.

An additional problem with the literature on understanding rules is that the rules normally are part of a learning environment which includes other information, such as sample problems. Sweller and his colleagues, for example, have found that students who study completed mathematics problems can perform as well as or better than students who practice similar problems (e.g., Cooper and Sweller 1987; Sweller and Cooper 1985). However, it is likely that other information in the examples, such as the answers to the problems, accounts for the performance differences. In a study which did not employ examples, Schoenfeld and Hermann (1982) showed that math students had performance gains from understanding-type instruction. However, in that study, students appear to have had significant practice and feedback. Consistent with this idea, Christensen and Cooper's (1991) math students who practiced problems performed better than students receiving only understanding rules. Thus, understanding rules alone are unlikely to promote more than minimal procedural knowledge acquisition.

Popular learning theories (e.g., Anderson 1982; Anzai and Simon 1979; Larkin 1981) generally support the idea that instruction is not conducive to procedural knowledge acquisition. Although largely untested, these theories suggest that instruction can provide only declarative knowledge, and that procedural knowledge must be acquired by compiling declarative knowledge through practice and feedback. Results of the two studies above which employed only how-to rules or understanding rules are consistent with these theories. In auditing, both how-to and understanding rules exist in audit manuals and firm training courses, and staff auditors must initially perform most tasks having had instruction only (Bonner and Pennington 1991). Thus, we examine the effects of both of these types of instruction on the acquisition of procedural auditing knowledge.

Experience. Additionally, individuals can acquire knowledge by doing tasks and receiving feedback after completing the tasks. Popular learning theories agree that some practice is necessary for the acquisition of the procedural knowledge needed for skilled tasks. These theories also require that practice be followed by accurate, complete, and informative feedback for procedural knowledge to be acquired. However, as noted previously, these theories are largely untested. Auditors receive virtually no feedback for some auditing tasks, only outcome feedback for other tasks, and more extensive feedback for tasks like ratio analysis (Bonner and Pennington 1991). Further, the quality and amount of feedback for any given task, such as ratio analysis, depend on the tests performed in a particular audit, the quality of the reviewers, and the surrounding environmental conditions (Waller and Felix 1984). Because of the variety of learning environments auditors face and the lack of research investigating theories about the acquisition of procedural knowledge from experience, we examine the effects of both practice without feedback and practice with various forms of feedback.

The results relating to practice without feedback support the theories' predictions. Schoenfeld and Hermann (1982) employed practice without feedback (and without instruction); in their group of subjects, there were no significant performance gains from semester beginning to semester end. In a meta-analysis of a large number of studies, Ross (1988) found that amount of task practice had no effect on knowledge acquisition. Practice without feedback can retard the acquisition of procedural knowledge and even decrease procedural knowledge for two reasons. First, because people experience cognitive overload while simultaneously inferring procedures and retrieving declarative knowledge (Owen and Sweller 1985), knowledge can be lost from working memory and never committed to long-term memory. Unfortunately, the eliminated knowledge may be relevant knowledge. In addition, without feedback, people simply may infer and maintain in memory inaccurate procedural knowledge. There is evidence that radiologists, progressing from a novice stage to an expert stage by looking at thousands of X-rays, experience

procedural knowledge (and performance) decreases in the “intermediate” stage (Lesgold 1984; Lesgold et al. 1988).

Research also has examined the effects of practice combined with two types of feedback on the acquisition of knowledge. These two types are *outcome feedback*, which provides information about the outcome or correct answer, and *task-properties feedback*, which provides an explanation of why the outcome occurred. The vast majority of results indicate that outcome feedback does not promote procedural knowledge acquisition, even in cases where the relation of inputs to the outcome exhibits little noise (see Balzer et al. 1989 for a review). Knowledge acquisition with outcome feedback is difficult because people change their procedures haphazardly based on what they infer from the outcomes, or simply infer incorrect procedures due to noise in the outcomes. In general then, practice with outcome feedback does not produce procedural knowledge.

In contrast, feedback providing an explanation of the properties of the task or such feedback combined with outcome feedback (called “explanatory feedback” here) generally promotes better acquisition of knowledge than outcome feedback alone (Balzer et al. 1989). Because people are told why the outcome occurred, they do not have to infer the explanation from the outcome.² Since people can assimilate the explanations with the outcome and any other information gained while practicing the task, they can acquire an understanding of the rules of the domain, or procedural knowledge (Ross 1988). In auditing, Hirst and Luckett (1992) and Hirst et al. (1992) found that auditors learned very rapidly from explanatory feedback.³

Although these findings are widely accepted, more recent research has suggested that outcome feedback can create procedural knowledge as can task-properties feedback or explanatory feedback under certain conditions. The first condition occurs when the task is sufficiently simple to enable subjects to reason backwards from the outcome and develop correct explanations (Hirst and Luckett 1992). This process requires that the task have a small number of information cues, have high predictability, or be simplified in other ways. In accounting, several studies have found results consistent with this idea. Subjects in Harrell’s (1977) study learned from outcome feedback in a perfectly predictable personnel evaluation task with a small number of information cues. Auditors performing a similar task in Hirst and Luckett’s (1992) study also learned from outcome feedback. Other studies have found learning in tasks which were not perfectly predictable, but which were quite simple on most dimensions. For example, auditors learned from outcome feedback in Ashton’s (1990) study, where the task required bond ratings based on an additive combination of three cues. Similarly, subjects learned from outcome feedback in the simplified ratio analysis task used by Nelson (1993).

The second proposed condition occurs when the subject possesses a causal theory of the domain prior to practicing the task and receiving outcome feedback. This knowledge allows the subject to interpret outcomes in a manner which is conducive to testing the relations of the theory and developing explanations (Camerer 1981). Although Camerer’s is the only study to examine this idea directly, several studies indirectly support it by showing that subjects who possess this type of knowledge prior to practicing tasks (and receiving outcome feedback) acquire procedural knowledge more readily (Anderson et al. 1981). Hirst and Luckett’s (1992) and Hirst et al.’s (1992) results support this view, since their auditor subjects had high previous knowledge

² In the laboratory, these explanations can always be made accurately. If explanatory feedback were to come from a reviewer, as might be the case in auditing, the accuracy of the explanation would depend on the quality of the reviewer’s knowledge.

³ In auditing, explanatory feedback (outcome feedback combined with task-properties feedback) is fairly similar to what might be provided by a reviewer. In this study, task-properties feedback cannot be provided without revealing the outcome, so explanatory feedback must be used.

Figure 2
Hypothesized Effects of Instruction and Experience Combinations
on Procedural Knowledge

<i>Experience</i>	<i>Instruction</i>		
	<i>No Instruction (Hypothesis)</i>	<i>How-to Rules (Hypothesis)</i>	<i>Understanding Rules (Hypothesis)</i>
No Experience	No change (H1a)	No change (H1b)	No change (H1c)
Practice Alone	No change (H2a)	No change (H2b)	No change (H2c)
Practice with Outcome Feedback	No change (H3a)	No change (H3b)	Increase (H3c)
Practice with Explanatory Feedback	Increase (H4a)	Increase (H4b)	Increase (H4c)

regarding staff evaluations or bankruptcy predictions. Support for the idea also comes from Bonner and Pennington's (1991) finding of a positive correlation of auditors' task performance with the amount of instruction provided *prior* to practice. If procedural knowledge is important to performance, this correlation may reveal that practice with outcome feedback aids in the acquisition of procedural knowledge if instruction as to the causal theory of the domain precedes practice.

Hypotheses about the Combined Effects of Instruction and Experience

Based on the literature reviewed above, predictions can be made about the effects on procedural knowledge of various *combinations* of instruction and experience (these predictions are summarized in figure 2). Examining these hypotheses allows us to specify more clearly the effects of instruction and experience on knowledge in Libby's (1993) model (see figure 1).

Subjects receiving combinations of no experience and any form of instruction will not acquire the procedural knowledge needed to do ratio analysis because neither how-to rules nor understanding rules are expected to create knowledge *per se*. This prediction leads to the following hypotheses:

- H1a: Subjects receiving no experience and no instruction will not acquire procedural knowledge.⁴
- H1b: Subjects receiving no experience and how-to rules will not acquire procedural knowledge.
- H1c: Subjects receiving no experience and understanding rules will not acquire procedural knowledge.

Subjects receiving combinations of practice alone and various forms of instruction are not expected to acquire procedural knowledge because practice without feedback normally does not

⁴In all hypotheses, "procedural knowledge" refers to the procedural knowledge needed for ratio analysis. Specific elements of this knowledge will be described later.

promote learning even if preceded by instruction. The addition of instruction could make the learning more difficult because it provides additional declarative knowledge to keep in mind while doing the task, increasing the chance of memory overload. This position leads to the following hypotheses:

- H2a: Subjects receiving practice alone and no instruction will not acquire procedural knowledge.
- H2b: Subjects receiving practice alone and how-to rules will not acquire procedural knowledge.
- H2c: Subjects receiving practice alone and understanding rules will not acquire procedural knowledge.

Subjects receiving outcome feedback also will not gain the procedural knowledge needed for ratio analysis unless they are provided with understanding rules prior to practicing the task. The other forms of instruction will not provide them with a causal framework within which to interpret the outcomes. The following hypotheses result:

- H3a: Subjects receiving practice with outcome feedback and no instruction will not acquire procedural knowledge.
- H3b: Subjects receiving practice with outcome feedback and how-to rules will not acquire procedural knowledge.
- H3c: Subjects receiving practice with outcome feedback and understanding rules will acquire procedural knowledge.

Finally, subjects with explanatory feedback will gain procedural knowledge irrespective of the form of instruction provided because the explanatory feedback itself provides them with both the outcome and the information needed to infer correct explanations. Thus, the following hypotheses are proposed:

- H4a: Subjects receiving practice with explanatory feedback and no instruction will acquire procedural knowledge.
- H4b: Subjects receiving practice with explanatory feedback and how to rules will acquire procedural knowledge.
- H4b: Subjects receiving practice with explanatory feedback and understanding rules will acquire procedural knowledge.

Effects of Ability on Knowledge Acquisition

A large body of research has shown that people acquire knowledge at different rates due to differences in aptitude (reviewed in Horn 1989; Kyllonen and Shute 1989; Snow 1989). The evidence suggests that general problem-solving ability is the aptitude which has the largest effect on the acquisition of knowledge, and that ability is related to the acquisition of procedural knowledge, specifically in the compilation of procedural knowledge from declarative knowledge (Ackerman 1989; Reber et al. 1991; Snow 1989). Libby and Tan (1993) provide some evidence that ability is related to the acquisition of knowledge in auditing, consistent with Libby's (1993) model (see figure 1). The following hypothesis is proposed:

- H5: General problem-solving ability will be positively related to procedural knowledge acquisition.

Effects of Ability and Knowledge on Performance in Ratio Analysis

In Libby's (1993) model, ability and experience affect knowledge acquisition, then knowledge and ability combine to determine performance (see figure 1). Previous research has shown a relation between knowledge and performance in ratio analysis tasks (Bedard and Biggs 1991; Bonner and Lewis 1990; Libby and Tan 1993). We examine that relation, specifically for procedural knowledge, through the following hypothesis:

H6: Procedural knowledge will be positively related to performance in ratio analysis.

Finally, although previous research has found a relation between ability and performance in ratio analysis (Bonner and Lewis 1990; Libby and Tan 1993), no such relation is predicted here. Libby (1993) predicts and Libby and Tan (1993) find support for the idea that ability should be related to performance only in unstructured tasks. The ratio analysis task in previous studies was such an unstructured task. Here, however, the task is structured for subjects. They are provided with four possible answers and a small amount of information adequate for solving the problems. According to Libby and Tan (1993), this task is structured since there are no requirements for generation of alternatives or search for information.⁵ The following hypothesis is proposed:

H7: General problem-solving ability will not be related to performance in a structured ratio analysis task.

II. Research Method

Subjects

Subjects for this study were 95 senior undergraduate and graduate students enrolled in the same basic auditing course at a large state university.⁶ In this course, subjects discussed the use of ratio analysis in audit planning, but had no previous experience using ratio analysis to detect financial statement errors.⁷ Most of these students were pursuing careers in public accounting, so they are similar to new staff accountants who would be converting declarative knowledge into procedural knowledge. More experienced auditors would have already acquired much of this procedural knowledge (Libby and Frederick 1990), so student subjects are appropriate for a study of the initial acquisition of procedural knowledge. Students volunteered to participate in the study in exchange for a \$7.50 hourly salary for their time and prizes awarded to the top performers in each session to maintain motivation.⁸

⁵Ratio analysis, as performed by auditors, will not always be as structured as is the case in this study. Auditors must generally generate hypotheses and search for information. As a result, ability may be related to ratio analysis performance when the task is less structured (e.g., Bonner and Lewis 1990).

⁶One hundred and three subjects participated in the experiment. The data for eight subjects were unusable due to computer malfunctions.

⁷This characteristic was verified with the post-study questionnaire.

⁸The incentive scheme, which provided *extrinsic* motivation, was the same for all subjects and was provided because of the length of the study. Further, a measure of *intrinsic* motivation did not differ across subject groups ($F=1.155$, $p=0.331$). This measure was the absolute value of the residual from an ANOVA where the dependent variable was time spent in the study phase, and the independent variable was the experience and instruction group. This residual reveals time spent in the study phase that is not accounted for by the instruction and experience group to which a subject was assigned. Since this additional time does not differ across groups, random assignment was successful in controlling for the effects of intrinsic motivation.

Procedures

The study was programmed for IBM personal computers to standardize instructions. Groups of between six and 24 people were tested in a computer laboratory which seats 40, leaving ample space for subjects to take notes and preventing them from seeing others' computer screens and notes. Subjects were given a code to begin the program; this code represented one of 12 instruction and experience groups to which they were randomly assigned. During the program, they read instructions and questions on the screen and typed their answers in from the keyboard. Subjects were allowed to take notes in a booklet of blank paper and to ask questions; because the computerized program was self-explanatory, few questions were asked. When finished, subjects turned in their disks and completed a questionnaire.

The use of a computer program allowed for the standardization of time spent in the study. Time limits were imposed on each question and each phase to ensure that subjects did not spend undue amounts of time on any. These time limits were pretested and were more than ample for subjects to complete the questions. Thus, incorrect answers were very likely due to a lack of knowledge rather than time pressure. Subjects spent approximately 80 to 140 minutes completing the study.

Task and Measurement of Variables

Combinations of Instruction and Experience. All subjects completed four phases: (1) knowledge pretest, (2) study phase, (3) test phase, and (4) knowledge posttest. The knowledge pretest and posttest and the test phase were the same for all groups of subjects. The study phase incorporated the 12 instruction and experience variable combinations. These combinations were all possible pairings of three types of instruction and four types of experience.

The forms of instruction were no instruction, how-to rules, and understanding rules. In the no instruction groups, no rules or procedures were provided except for general directions and the definitions of the four ratios. The how-to rules groups simply saw a list of procedures to follow in hypothesizing errors from ratio fluctuations, including steps like:

If there are any "significant" differences, hypothesize possible accounting errors or irregularities that could have caused the pattern of ratio differences you have.

Check your hypotheses before planning further work. Work out the accounting effects of the errors or irregularities you proposed and determine if the ratios would in fact change in the direction you found.

These rules were developed from a former Big Eight firm's audit manual and were, therefore, very similar to the instruction currently provided by some firms (Ernst & Whinney 1986). In addition, they are similar to the how-to rules used in previous research (Post and Brennan 1976).

The understanding rules incorporated the how-to rules and provided more explanation for each step. For the step regarding hypothesizing differences, the understanding rule explained that:

The best way to do this is to break the ratios down into their numerator and denominator components and think about what could have made the overall ratio be higher than expected or lower than expected.

The rule also explained the conditions under which a ratio would be higher or lower than expected in general, then for the four specific ratios used here. These rules were designed to be something like the procedural knowledge needed to do the task, but were not expected to produce procedural knowledge because of the difficulty of acquiring procedural knowledge through instruction alone. The total time allowed to read instruction screens was similar to the total time allowed for various forms of experience in the study phase.

Both practice and feedback were included in the experience variable, because feedback clearly cannot be provided unless a person has done the task. The four types of practice and feedback were no experience, practice alone, practice with outcome feedback, and practice with explanatory feedback. In the groups receiving something other than no experience, subjects were told that they would work eight problems, each of which contained four ratios, their expected values, and their actual (unaudited) values. They were then told that each problem contained the ratios for a separate widget manufacturer, so that they were to consider each problem independent of other problems. Further, they were told that expected values would be the same in each problem because expectations were developed based on widget industry averages. These instructions are similar to those used by Nelson (1993).

In the three practice alone groups (combined with no instruction, how-to rules, or understanding rules), subjects worked the eight ratio analysis problems.⁹ For each problem, subjects had a time limit of four minutes. If they finished before four minutes, they were allowed to proceed. The groups with practice *and* feedback had the same eight problems and subjects proceeded in the same way, except that when subjects typed in their answer, they received feedback regarding whether their answer was correct. Outcome feedback was provided in the form of one of the following statements, which flashed on the screen: "Answer (a) was correct" or "Answer (a) was incorrect. The correct answer was (c)." Once the feedback statement appeared, subjects had up to two minutes to study this information and to take notes. Again, if they were finished before two minutes, they were allowed to proceed. Two minutes was a large amount of time for these subjects, but was provided to equalize total possible time to read feedback given for feedback between the outcome and explanatory feedback groups.¹⁰

In the three practice with explanatory feedback conditions, the feedback appeared on the next screen and consisted of one of the two statements above, along with an explanation of the answer. That explanation consisted of a description of how the correct error affected financial statement accounts, e.g., "this error causes inventory and accounts payable to be overstated." The explanation then described how those misstatements affected each of the ratios. We only provided this explanation for the correct answer (rather than for the answer the subjects chose) to ensure that all subjects received the same feedback.¹¹ Subjects could move back and forth between the problem and explanatory feedback screens to make notes before proceeding. Finally, in the no experience groups, subjects worked no problems. In the no instruction, no experience combination, subjects read information on internal control evaluation, which was of approximately the same length as the ratio analysis instruction. This information gave the subjects no opportunity to acquire the procedural knowledge needed for ratio analysis.

Knowledge Pretest and Posttest. The knowledge pretest and posttest were used to measure declarative and procedural knowledge. All the declarative and procedural knowledge questions

⁹Eight problems should be sufficient to acquire some procedural knowledge since other studies have shown that people can acquire this knowledge from one problem (e.g., Ahn et al. 1992; Anderson et al. 1981).

¹⁰Another approach would be to allow a fixed amount of time to read feedback for both groups and not to allow subjects to move ahead until the time expired. This structure would ensure that actual time spent was equalized across groups. Unfortunately, this procedure runs the risk of inducing boredom and, thus, poorer performance in outcome feedback groups. The approach of allowing subjects to progress at their own speed controls for possible fatigue and boredom effects. On the other hand, time spent in the study may be confounded somewhat with the experience and instruction combinations. In this study, however, actual time spent cannot explain the results. For example, subjects with understanding rules, on average, spent more time in the study than subjects with how-to rules, but generally did not perform better than the latter group. Further, subjects with practice alone generally spent more time than those with no experience, but again did not perform better. Finally, time that subjects spent which is not accounted for by the experience and instruction combinations (the residual) did not differ across groups (see note 8).

¹¹In the field, many experienced auditors would likely take the additional time to explain why a staff auditor's chosen answer was incorrect. As a result, our findings for explanatory feedback may be conservative.

were related to the cycles of transactions and accounts reflected by the ratios (sales/accounts receivable, cash receipts, purchases/payables, and cash disbursements). These transaction cycles are the ones students tend to hear about first and those which represent the “typical” company. All questions were multiple-choice with four answers. The order of presentation of questions and answers within questions was randomized and held constant across subjects. The posttest included the same questions as in the pretest, except that the questions (and answers within questions) were randomized to produce a different ordering than that in the pretest.

The declarative knowledge needed to do ratio analysis includes the following: (1) classifications of items on financial statements, such as which accounts comprise current assets; (2) definitions of summary items on financial statements, such as gross margin; (3) journal entries for various transactions; and (4) definitions of financial ratios, such as $\text{current ratio} = \text{current assets} / \text{current liabilities}$. A total of 12 declarative knowledge questions included two on classification of accounts, three on definitions of summary items, five on journal entries, and two on ratio definitions. (See appendix A.) These 12 questions covered a large part of the factual knowledge needed for the ratio analysis task. About half the questions were taken from CPA exams, and about half were constructed by the authors on the basis of similar CPA questions.¹² The score on this section of the test served as the measure of declarative knowledge.¹³

The procedural knowledge needed for ratio analysis includes the following: (1) rules on the mathematics of ratios, (2) rules for the effects of financial statement errors on account balances, (3) rules showing what types of errors could have caused specific accounts to be overstated or understated, and (4) rules showing what types of errors could have caused individual ratios to be overstated or understated. These rules are not facts normally taught in accounting or auditing classes and must be compiled through interpreting declarative knowledge. For example, rules showing what types of errors could have caused summary account misstatements must be compiled from declarative knowledge of journal entries, definitions of summary accounts, and inferences regarding direction of misstatements. This part of the knowledge test again included 12 questions, three on the effects of numerator/denominator changes on generic ratios, three on the effects of accounting errors on account balances, three on which errors could cause misstatements of accounts, and three on which errors could cause misstatements of ratios. (See appendix B.) Construction of the questions was similar to that described above.¹⁴ The score on these 12 questions served as the measure of procedural knowledge.¹⁵

Finally, in the knowledge posttest only, general problem-solving ability was measured using the same eight GRE questions validated by Bonner et al. (1992). These eight questions, used on the GRE to measure general ability, included two questions about analogical reasoning ability, three about analytical reasoning ability, and three about data interpretation ability.

Ratio Analysis Problems used in Study Phase and Test Phase. A total of 16 ratio analysis problems were developed, eight for the study phase and eight for the test phase. (See appendix

¹² No measures of reliability are reported for these questions for the following reasons. First, declarative accounting knowledge is an omnibus construct, encompassing several subconstructs such as knowledge of journal entries. An overall reliability measure for the 12 declarative knowledge questions would not be meaningful. An alternative approach would be to determine the reliability of the measures of the subconstructs, but each of these measures encompasses an insufficient number of questions to achieve a reasonable reliability. The time to do all four phases of the study required that the knowledge test be kept to a reasonable length while covering as many pieces of the knowledge as possible. Unfortunately, only a few questions could be devoted to each subconstruct.

¹³ Waller and Felix (1984) discuss this type of knowledge when describing the declarative accounting knowledge possessed by students.

¹⁴ The discussion of reliability in footnote 12 applies here as well.

¹⁵ Although the distinction between declarative and procedural knowledge is not always clear, correlations of 0.204 and 0.051 (at pretest and posttest, respectively) between the two measures indicate they are at least measured distinctly.

C.) All subjects did the eight test phase problems; the number of correct answers given to these problems served as the measure of performance in ratio analysis. Subjects in nine of the 12 groups (those other than the three no experience groups) worked problems during the study phase. Each problem presented the names of four financial ratios (current ratio, inventory turnover, receivables turnover, and gross margin ratio) and their expected and actual (unaudited) values, then asked: "Which of the following errors or irregularities could have caused the differences between actual and expected ratios?" Subjects typed in the letter for the answer they thought to be correct, then proceeded to the next problem (after viewing feedback, in the feedback conditions).

The four ratios are among those most commonly used by auditors in doing ratio analysis (Libby 1985). To construct the 16 problems, we generated all possible combinations of changes in the four ratios (higher than expected, as expected, and lower than expected); this gave us 81 possible sets of ratio fluctuations (3^4). Then we matched financial statement errors from Coakley and Loebbecke (1985) to the sets of ratio fluctuations. Several sets were eliminated because we could generate no errors to account for them. After this procedure, there were 20 sets of ratios and errors; the frequencies of these errors were relatively close (at a medium level). To derive our final set of problems, we eliminated four errors that were similar to other errors. Then, the 16 problems were split into two sets of eight problems that had similar distributions of difficulty levels. The expected values of the ratios were constant across problems because the values were chosen to be representative of "typical" manufacturing companies. The unaudited (current) values were set based on the predicted effects of the financial statement errors (higher than expected, as expected, or lower than expected). If the error had no effect on the ratio, the expected value was shown again; no random variation was introduced. If the ratios were not as expected, predetermined higher and lower numbers were presented. Higher (lower) numbers were determined by adding (subtracting) 0.6 to the expected values for the first three ratios and 0.2 for the gross margin ratio. Pilot tests indicated these fluctuations were large enough to be perceived as unusual fluctuations.

In each problem, subjects saw four possible errors as answers and were asked to type the letter for the correct answer. The 16 errors served as the correct answers and also served as incorrect answers in other problems. The incorrect answers were chosen based on their ability to be good distractors, i.e., on the number of ratio fluctuations that they matched. Ninety-six percent of the incorrect answers could explain either two or three (out of four) of the ratio fluctuations.

Post-Study Questionnaire. After turning in their disks, subjects completed a questionnaire which included checks on attention to the instruction and experience types and questions on background variables. The attention checks asked subjects to respond to the following two statements by marking on a seven-point scale (ranging from "strongly disagree" to "strongly agree"): "In Phase 2 (study phase) of this experiment, I was asked to read a series of procedures describing how to do ratio analysis" and "In Phase 2 (study phase) of this experiment, I was asked to work a series of problems relating to ratio analysis." Then, subjects went on to answer questions about their training and experience with ratio analysis, experience in public accounting, current and past degrees, CPA review courses taken, and level of comfort with IBM personal computers.

III. Results

Declarative Knowledge, Background Variables, and Attention Checks

Declarative knowledge was measured at pretest and posttest to ensure that subjects had adequate knowledge of financial accounting facts needed to acquire procedural knowledge and that groups did not differ. An ANOVA with groups as the independent variable indicated that subjects did not differ across groups at pretest ($F=0.712, p=0.724$) or posttest ($F=1.269, p=0.257$).

At pretest, the mean level of knowledge was 8.2 correct answers (out of 12). At posttest, the mean was 10.2; this increase was due primarily to subjects' learning the ratio definitions which were provided at the beginning of the study phase.¹⁶ There were also no differences across groups for any of the background variables. Thus, these variables are not included in the analyses. Finally, ratings on the attention check questions indicated that subjects attended to the instruction and experience variables. The average rating of groups with experience ($\bar{x}=4.08$, $s.d.=1.213$) was higher ($F=45.383$, $p=0.000$) than that of groups with no experience ($\bar{x}=2.00$, $s.d.=1.477$). The instruction groups' average rating was 4.09 ($s.d.=1.178$), and the no instruction groups' average rating was 2.4 ($s.d.=1.336$); these were significantly different ($F=38.082$, $p=0.000$).

Effects of Instruction and Experience Combinations on Procedural Knowledge Acquisition (Hypotheses H1-H4)

For each instruction/experience group, table 1 presents means (and standard deviations) of procedural knowledge at pretest and posttest arranged according to the hypothesis to which they pertain, signed changes in knowledge from pretest to posttest, and paired, two-tailed t-tests for posttest knowledge versus pretest knowledge. Two-tailed tests are appropriate because of the possibility of both knowledge increases and decreases. Also presented in table 1 are the comparable results from the Wilcoxon signed-ranks test (Siegel 1956).

Hypothesis H1 (No Experience). Hypotheses H1a, H1b, and H1c predict that any combination of instruction and no experience will not increase procedural knowledge. Hypotheses H1a and H1c are supported (with both the parametric and nonparametric test results). Hypothesis H1b is not supported because the group with how-to rules and no experience acquired knowledge.¹⁷

Hypothesis H2 (Practice Alone). Hypotheses H2a, H2b, and H2c are supported (with both tests) for the groups having combinations of practice alone and, respectively, no instruction, how-to rules, and understanding rules. Since feedback appears to be necessary for the acquisition of procedural knowledge, no combination of practice without feedback and instruction would be expected to promote acquisition of this knowledge.

Hypothesis H3 (Practice with Outcome Feedback). Hypotheses H3a and H3b predict that practice with outcome feedback, combined with either no instruction or minimal how-to instruction, will not assist people in acquiring procedural knowledge. These hypotheses are supported by the results for those two groups, shown in table 1. Hypothesis H3c, on the other hand, predicts that subjects who receive understanding rules prior to practice with outcome feedback will be able to acquire procedural knowledge. Results for both tests support this prediction. Overall then, the effect of practice with outcome feedback on the acquisition of the procedural knowledge needed to do ratio analysis depends on the form of instruction with which it is paired. Understanding rules apparently provide a sufficient causal framework within which to interpret outcomes and infer accurate procedural knowledge of this type. The provision of understanding rules prior to experience is consistent with Blocher et al.'s (1992) suggestion that subjects must have domain knowledge in order to learn to do ratio analysis from outcome feedback.

¹⁶ Since not all declarative knowledge is needed to acquire procedural knowledge, an average of 85 percent is acceptable (c.f., Willingham et al. 1989).

¹⁷ One possible explanation for this result is that one subject in this group, whose knowledge increased substantially, spent almost twice as much time answering questions on the posttest as on the pretest. In contrast, other subjects in this group (and other groups) generally spent either a similar or a smaller amount of time on the posttest. This difference likely reflects the fact that this subject moved too quickly through the pretest, resulting in a pretest score that understated his knowledge and a change from pretest to posttest that substantially overstated his learning. Because of the small group size, this large increase appears to be driving the results.

Table 1
T-Tests and Wilcoxon Signed-Ranks Tests by Group of Procedural Knowledge at Posttest versus Procedural Knowledge at Pretest
(n=8 in each group, except first group in which n=7)

<i>Hypothesis</i>	<i>Experience</i>	<i>Instruction</i>	<i>Mean Procedural Knowledge at Pretest (s.d.)</i>	<i>Mean Procedural Knowledge at Posttest (s.d.)</i>	<i>Signed Change in Procedural Knowledge</i>	<i>t-Test Probability</i>	<i>Ranks Test Probability</i>
H1a	None	None	7.286 (1.496)	8.429 (1.134)	+1.143	0.121	0.109
H1b	None	How-to Rules	7.250 (1.389)	8.750 (1.389)	+1.500	0.020	0.028
H1c	None	Understanding Rules	7.875 (2.232)	8.375 (1.302)	+0.500	0.563	0.944
H2a	Practice Alone	None	8.750 (1.581)	7.625 (1.302)	-1.125	0.219	0.263
H2b	Practice Alone	How-to Rules	7.500 (1.512)	7.750 (0.886)	+0.250	0.598	0.529
H2c	Practice Alone	Understanding Rules	7.625 (1.061)	8.375 (1.408)	+0.750	0.285	0.310
H3a	Practice w/OF	None	7.500 (1.604)	8.250 (2.188)	+0.750	0.222	0.201
H3b	Practice w/OF	How-to Rules	8.250 (1.389)	8.625 (1.061)	+0.375	0.476	0.463
H3c	Practice w/OF	Understanding Rules	7.125 (0.641)	9.000 (1.512)	+1.875	0.006	0.018
H4a	Practice w/EF	None	8.125 (0.354)	9.625 (1.685)	+1.500	0.026	0.042
H4b	Practice w/EF	How-to Rules	7.500 (0.926)	9.625 (1.302)	+2.125	0.006	0.020
H4c	Practice w/EF	Understanding Rules	8.500 (2.070)	10.250 (1.282)	+1.750	0.064	0.058

Hypotheses in *italics* are those with predicted increases in procedural knowledge.

OF=Outcome Feedback

EF=Explanatory Feedback

Hypothesis H4 (Practice with Explanatory Feedback). Hypotheses H4a, H4b, and H4c predict that practice with explanatory feedback will promote knowledge acquisition, irrespective of the form of instruction. These hypotheses are supported by the results shown in table 1. If high quality explanatory feedback is available, instruction may be marginally beneficial, though it may not be necessary.

Additional Analysis. To examine more directly the idea that the combination of understanding rules and practice with outcome feedback promotes knowledge acquisition as well as does explanatory feedback, *post hoc* comparisons were performed. The following two comparisons were made: (1) procedural knowledge in the understanding rules-outcome feedback group (H3c in figure 2) to procedural knowledge in the no instruction-outcome feedback group (H3a), and (2) procedural knowledge in the understanding rules-explanatory feedback group (H4c) to procedural knowledge in the no instruction-explanatory feedback group (H4a). Procedural knowledge should be greater in the H3c group than in the H3a group, showing that the effect of outcome feedback is contingent on the presence of understanding rules. In contrast, there should be no difference in procedural knowledge between the H4c and H4a groups, showing that the effect of explanatory feedback is not contingent on the form of instruction with which it is paired. In combination with the above results indicating increases in procedural knowledge for the H3c, H4a, and H4c groups and no change for the H3a group, these results would suggest that the combination of understanding rules and practice with outcome feedback might be a reasonable substitute for explanatory feedback.

These comparisons were done with both parametric and nonparametric methods, and compared procedural knowledge-posttest in one group to that in the other group (controlling for the effects of procedural knowledge-pretest). Using the Tukey least significant difference approach (Sokal and Rohlf 1969), the comparison of the H3c group to the H3a group showed a marginally significant difference ($T=1.125$, $0.05 < p < 0.10$, two-tailed), and the comparison of the H4c group to the H4a group showed a nonsignificant difference ($T=0.25$, $0.60 < p < 0.80$, two-tailed). Similar results were found using Kruskal-Wallis one-way ANOVAs (Siegel 1956). These comparisons found a marginally significant, positive difference between H3c and H3a ($H=2.79$, $0.05 < p < 0.10$, two-tailed) and no difference between H4c and H4a ($H=0.14$, $0.70 < p < 0.80$, two-tailed). Thus, at least for tasks that are not extremely simple, acquisition of auditing knowledge from outcome feedback is not possible unless practice is preceded by understanding rules. On the other hand, acquisition of knowledge under these outcome feedback conditions is similar to knowledge acquisition under the more costly condition of explanatory feedback.

Summary. As predicted, persons receiving either no experience or practice alone, combined with any form of instruction, did not acquire the procedural knowledge needed to do ratio analysis. The only exception was the no experience, how-to rules group (H1b) who appeared to have acquired knowledge. Those receiving outcome feedback also did not acquire procedural knowledge unless they first received understanding rules. The group with understanding rules and outcome feedback posted over a 26 percent increase in performance on a knowledge test during a relatively short period. In contrast, persons receiving explanatory feedback were able to acquire this procedural knowledge, irrespective of the form of instruction, probably because they were able to assimilate the explanations directly and create rules. These groups averaged about a 21 percent increase in their performance on the knowledge test. Based on the additional analyses, understanding rules coupled with practice and outcome feedback appears to be an adequate substitute for explanatory feedback, one that would allow beginning auditors to gain the procedural knowledge needed for ratio analysis.

Table 2
Regression of Procedural Knowledge at Posttest on Procedural Knowledge
at Pretest and Problem-Solving Ability
(n=95)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t</i>	<i>Probability</i>
Constant	5.739	0.949	6.045	0.000
Procedural Knowledge at Pretest	0.203	0.104	1.956	0.053
Problem-Solving Ability	0.324	0.129	2.518	0.014

$R^2=0.109$

Effect of Ability on Procedural Knowledge Acquisition (Hypothesis H5)

Table 2 presents a regression of procedural knowledge-posttest on pretest knowledge and ability (pretest knowledge is included to control for differences across individuals). Problem-solving ability is positively related to procedural knowledge at posttest, suggesting that people with higher levels of ability may either gain more procedural knowledge or acquire it more rapidly than those with lower levels of abilities.¹⁸

Effects of Procedural Knowledge and Ability on Performance (Hypotheses H6 - H7)

To examine the remaining links in Libby's (1993) model, a regression was done with performance in the test phase as the dependent variable and procedural knowledge and problem-solving ability as the independent variables. As shown in table 3, procedural knowledge is positively related to performance and problem-solving ability is not related to performance. The variance explained by procedural knowledge is small, probably because the procedural knowledge test was necessarily short and, therefore, did not capture all the procedural knowledge needed for ratio analysis.¹⁹

IV. Summary and Conclusions

Using Libby's (1993) model of the acquisition of audit expertise, this paper examined the effects of various combinations of instruction, experience, and general ability on the acquisition of the procedural knowledge needed for ratio analysis, as well as the effects of procedural knowledge and ability on ratio analysis performance. Except for the group of subjects receiving only how-to rules and no experience, results were consistent with the predictions that subjects

¹⁸ None of the regression assumptions were violated. An ANOVA using posttest procedural knowledge as the dependent variable, pretest knowledge and ability as covariates, and the 12 experience and instruction combinations as groups, produces an R^2 of 0.347, suggesting that the procedural knowledge test does not capture all the procedural knowledge needed to perform ratio analysis. Since the test contained only 12 questions, this outcome is likely. Ability was still significant after accounting for the effects of the experience/instruction combinations ($p=0.011$).

¹⁹ None of the regression assumptions were violated. An ANOVA using ratio analysis performance as the dependent variable, procedural knowledge and ability as covariates, and the 12 experience and instruction combinations as groups, produces an R^2 of 0.304. In this ANOVA, the relation of procedural knowledge to performance was still significant ($p=0.055$) and the relation of ability to performance was still nonsignificant ($p=0.208$).

Table 3
Regression of Performance in Ratio Analysis on Procedural
Knowledge at Posttest and Problem-Solving Ability
(n=95)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-value</i>	<i>Probability</i>
Constant	2.425	1.030	2.354	0.021
Procedural Knowledge	0.233	0.113	2.074	0.041
Problem-Solving Ability	-0.058	0.146	-0.393	0.695

$R^2=0.045$

receiving combinations of no experience or practice alone and any form of instruction would not gain procedural knowledge. All other results were as predicted. Practice with outcome feedback, unless combined with understanding rules, did not increase procedural knowledge. However, outcome feedback coupled with understanding rules did increase procedural knowledge. Additional analyses showed that the addition of understanding rules to outcome feedback is what creates these gains. This finding is consistent with previous research in accounting which found learning from outcome feedback in the presence of prior knowledge (e.g., Hirst and Luckett 1992; Hirst et al. 1992). Practice with explanatory feedback and any form of instruction increased procedural knowledge. General ability aided in the acquisition of procedural knowledge. Finally, procedural knowledge was related to performance in ratio analysis, but ability was not.

This study is the first to examine the specific effects on procedural knowledge acquisition of various combinations of instruction and experience available in the audit environment. The study characterizes two forms of instruction that universities and accounting firms currently use—how-to rules and understanding rules—and demonstrates that understanding rules allow auditors to learn under what would normally be considered an impoverished condition, that of outcome feedback. This result, of course, must be interpreted with caution because outcome feedback is not always available for audit tasks other than ratio analysis or on all audits. However, the finding is quite important because time and other pressures faced by auditors in the field often make it difficult to provide high-quality explanatory feedback. Understanding rules provide information similar to explanatory feedback, but are set in a more general context than that of individual problems. As such, they provide an overall causal model which may allow auditors to interpret outcomes in a variety of contexts. How-to rules, on the other hand, do not seem to assist people in acquiring procedural knowledge most of the time; this finding raises concerns since firm training programs and audit manuals may include only how-to rules for ratio analysis and other tasks. General problem-solving ability aids auditors in acquiring the procedural knowledge needed for ratio analysis, a result which may have important implications for hiring and job assignments.

Several avenues for future research are suggested by the results and limitations of this study. First, since this study examined only a subset of the combinations of instruction and experience available to auditors, future research should examine the effects of other forms of instruction, such as examples, and experience, such as working in groups. On the other hand, the examination of several combinations created small group sizes; the number of subjects in each group must be balanced against the number of combinations being examined. Second, experience groups in this

study received immediate feedback; the effectiveness of both outcome feedback and explanatory feedback may be diminished with delays (e.g., Lewis and Anderson 1985). Third, a brief objective knowledge test was used to measure procedural knowledge in this study. Given the previously noted difficulties of measuring procedural knowledge, further effort should be devoted to exploring this issue. Fourth, future research should employ attention and manipulation checks to ensure that subjects attend to their group assignments. Finally, further research should examine the effectiveness of changes in practice and education suggested by the results of this and other studies of auditor learning.

Appendix A

Example Declarative Knowledge Questions

Classification of Items on Financial Statements

Which one of the following is not a current asset?

- a. Patent.
- b. Inventory.
- c. Accounts receivable.
- d. Cash.

Definitions of Summary Items on Financial Statements

Which of the following is subtracted from gross accounts receivable to obtain net accounts receivable?

- a. Bad debts expense.
- b. Sales discounts taken.
- c. Bad debts allowance.
- d. Sales returns and allowances.

Journal Entries for Transactions

Smith & Co. receives \$1,000 from a customer in payment of an account receivable. The journal entry would be:

- a. A debit to cash for \$1,000 and a credit to sales for \$1,000.
- b. A debit to sales for \$1,000 and a credit to accounts receivable for \$1,000.
- c. A debit to accounts receivable for \$1,000 and a credit to cash for \$1,000.
- d. A debit to cash for \$1,000 and a credit to accounts receivable for \$1,000.

Definitions of Financial Ratios

How is net sales used in the calculation of the following?

<i>Receivables Turnover</i>	<i>Gross Margin Ratio</i>
a. Numerator	Numerator
b. Denominator	Denominator
c. Not used	Numerator
d. Numerator	Denominator

Appendix B

Example Procedural Knowledge Questions

Rules on the Mathematics of Ratios

Assume that the ratio of P to Q is 6 to 2. What effect would P's decreasing by twice as much as Q have on the ratio?

- a. Increase the ratio.
- b. Decrease the ratio.
- c. No effect on the ratio.
- d. Answer cannot be determined from the information given.

Rules for the Effects of Financial Statement Errors on Account Balances

What would be the result of recording sales at year-end even though the goods were not shipped?

- a. Overstate accounts receivable.
- b. Overstate inventory.
- c. Understate cash.
- d. Understate sales.

Rules Showing What Types of Errors could have Caused Accounts to be Misstated

Which of the following could have caused inventory to be understated?

- a. Failing to record collections from receivables.
- b. Goods returned by customers not counted in inventory.
- c. Labor and overhead recorded in excess of actual amounts throughout the year.
- d. Expensing items that should be recorded as prepaids.

Rules Showing What Types of Errors could have Caused Ratios to be Misstated

Which of the following could have caused the gross margin ratio to be overstated?

- a. Recording too many items on the sales invoice and in sales while all shipping documents and inventory entries done correctly.
- b. Recording tax accruals twice.
- c. Recording more hours than actually worked to manufacture a finished product later sold.
- d. Expensing items that should be recorded as prepaids.

Appendix C

Example Ratio Analysis Problem

	<i>1989 Expected</i>	<i>1989 Actual (Unaudited)</i>
Current Ratio	2.5	3.1
Inventory Turnover	4.4	5.0
Receivables Turnover	5.5	4.9
Gross Margin Ratio	0.4	0.4

Which of the following errors or irregularities could have caused the differences between actual and expected ratios?

- a. Failing to record collections from receivables.

- b. Recording sales and related inventory/cost of goods sold entries at year-end even though goods were not shipped.
- c. Adjusting perpetual records incorrectly due to failure to count all goods in warehouse (cost of goods sold correct).
- d. Recording payments on accounts payable twice.

References

- Ackerman, P. L. 1989. Individual differences and skill acquisition. In *Learning and Individual Differences: Advances in Theory and Research*, edited by P. L. Ackerman, R. J. Sternberg, and R. Glaser, pp. 164-217. New York: W. H. Freeman & Co.
- Ahn, W., W. F. Brewer, and R. J. Mooney. 1992. Schema acquisition from a single example. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 18 (March): 391-412.
- Anderson, J. R. 1982. Acquisition of cognitive skill. *Psychological Review* 89 (July): 369-460.
- _____, J. R. Greeno, P. J. Kline, and D. M. Neves. 1981. Acquisition of problem-solving skill. In *Cognitive Skills and Their Acquisition*, edited by J. R. Anderson, pp. 191-230. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Anzai, Y., and H. A. Simon. 1979. The theory of learning by doing. *Psychological Review* 86 (March): 124-40.
- Arens, A. A., and J. K. Loebbecke. 1991. *Auditing: An Integrated Approach* (fifth edition). Englewood Cliffs, NJ: Prentice Hall.
- Ashton, R. H. 1990. Pressure and performance in accounting decision settings: Paradoxical effects of incentives, feedback, and justification. *Journal of Accounting Research* 28 (Supplement): 148-80.
- Balzer, W. K., M. E. Doherty, and R. O'Connor. 1989. Effects of cognitive feedback on performance. *Psychological Bulletin* 106 (November): 410-33.
- Bedard, J., and S. Biggs. 1991. Pattern recognition, hypotheses generation, and auditor performance in an analytical task. *The Accounting Review* 66 (July): 622-42.
- Biggs, S. F., and J. J. Wild. 1984. A note on the practice of analytical review. *Auditing: A Journal of Practice & Theory* (Spring): 68-70.
- Blocher, E., M. J. Bouwman, and C. E. Davis. 1992. Experience and expertise in analytical review: Will the real experts please identify themselves? Working paper, University of North Carolina, Chapel Hill.
- Bonner, S. E., J. S. Davis, and B.R. Jackson. 1992. Expertise in corporate tax planning: The issue identification stage. *Journal of Accounting Research* 30 (Supplement): 1-28.
- _____, and B. L. Lewis. 1990. Determinants of auditor expertise. *Journal of Accounting Research* 28 (Supplement): 1-20.
- _____, and N. Pennington. 1991. Cognitive processes and knowledge as determinants of auditor expertise. *Journal of Accounting Literature* 10: 1-50.
- Butt, J. L. 1988. Frequency judgments in an auditing-related task. *Journal of Accounting Research* 26 (Autumn): 315-30.
- Camerer, C. F. 1981. The validity and utility of expert judgment. Ph.D. dissertation, University of Chicago.
- Christensen, C. A., and T. J. Cooper. 1991. The effectiveness of instruction in cognitive strategies in developing proficiency in single-digit addition. *Cognition and Instruction* 8 (4): 363-71.
- Coakley, J. R., and J. K. Loebbecke. 1985. The expectation of accounting errors in medium-sized manufacturing firms. *Advances in Accounting* 2: 199-246.
- Cooper, G., and J. Sweller. 1987. Effects of schema acquisition and rule automation on mathematical problem-solving transfer. *Journal of Educational Psychology* 79 (December): 347-62.
- Ernst & Whinney. 1986. *Guide to the Ernst & Whinney Audit Approach*. Cleveland: Ernst & Whinney.
- Harrell, A. 1977. The decision-making behavior of Air Force officers and the management control process. *The Accounting Review* 52 (October): 833-41.
- Hirst, M. K., and P. F. Luckett. 1992. The relative effectiveness of different types of feedback in performance evaluation. *Behavioral Research in Accounting* 4: 1-22.

- _____, _____, and K. T. Trotman. 1992. Effects of feedback and task predictability on the accuracy and confidence of judgments. Working paper, University of New South Wales.
- Horn, J. L. 1989. Cognitive diversity: A framework of learning. In *Learning and Individual Differences: Advances in Theory and Research*, edited by P. L. Ackerman, R. J. Sternberg, and R. Glaser, pp. 61-116. New York: W. H. Freeman & Co.
- Kyllonen, P. C., and V. J. Shute. 1989. A taxonomy of learning skills. In *Learning and Individual Differences: Advances in Theory and Research*, edited by P. L. Ackerman, R. J. Sternberg, and R. Glaser, pp. 117-63. New York: W. H. Freeman & Co.
- Larkin, J. H. 1981. Enriching formal knowledge: A model for learning to solve textbook physics problems. In *Cognitive Skills and Their Acquisition*, edited by J. R. Anderson, pp. 311-34. Hillsdale, NJ: Lawrence Erlbaum Associates.
- LeFevre, J., and P. Dixon. 1986. Do written instructions need examples? *Cognition and Instruction* 3 (1): 1-30.
- Lesgold, A. M. 1984. Acquiring expertise. In *Tutorials in Learning and Memory: Essays in Honor of Gordon Bower*, edited by J. R. Anderson and S. M. Kosslyn, pp. 31-60. New York: W. H. Freeman & Co.
- _____, H. Rubinson, P. Feltovich, R. Glaser, D. Klopfer, and Y. Wang. 1988. Expertise in a complex skill: Diagnosing x-ray pictures. In *The Nature of Expertise*, edited by M. T. H. Chi, R. Glaser, and M. J. Farr, pp. 311-42. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Lewis, M. W., and J. R. Anderson. 1985. Discrimination of operator schemata in problem solving: Learning from examples. *Cognitive Psychology* 17 (January): 26-65.
- Libby, R. 1985. Availability and the generation of hypotheses in analytical review. *Journal of Accounting Research* 23 (Autumn): 648-67.
- _____. 1993. The role of knowledge and memory in audit judgment. In *Judgment and Decision Making Research in Accounting and Auditing*, edited by R. H. Ashton and A. H. Ashton, forthcoming. Cambridge, MA: Cambridge University Press.
- _____, and D. M. Frederick. 1990. Experience and the ability to explain audit findings. *Journal of Accounting Research* 28 (Autumn): 348-67.
- _____, and H.-T. Tan. 1993. Modeling the determinants of audit expertise. Working paper, Cornell University.
- Nelson, M. W. 1993. The effects of error frequency and accounting knowledge on error diagnosis in accounting review. Working paper, Cornell University.
- Owen, E., and J. Sweller. 1985. What do students learn while solving mathematics problems? *Journal of Educational Psychology* 77 (June): 272-84.
- Post, T. R., and M. L. Brennan. 1976. An experimental study of the effectiveness of a formal versus an informal presentation of a general heuristic process on problem-solving in tenth-grade geometry. *Journal for Research in Mathematics Education* (January): 59-64.
- Reber, A. S., F. F. Walkenfeld, and R. Hernstadt. 1991. Implicit and explicit learning: Individual differences and IQ. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 17 (September): 888-96.
- Ross, J. A. 1988. Controlling variables: A meta-analysis of training studies. *Review of Educational Research* 58 (Winter): 405-37.
- Rumelhart, D., and D. Norman. 1981. Analogical processing in learning. In *Cognitive Skills and Their Acquisition*, edited by J. R. Anderson, pp. 335-60. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Schoenfeld, A. H., and D. J. Hermann. 1982. Problem perception and knowledge structure in expert and novice mathematical problem solvers. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 8 (September): 484-94.
- Siegel, S. 1956. *Nonparametric Statistics for the Behavioral Sciences*. New York: McGraw-Hill.
- Snow, R. E. 1989. Aptitude-treatment interaction as a framework for research on individual differences in learning. In *Learning and Individual Differences: Advances in Theory and Research*, edited by P. L. Ackerman, R. J. Sternberg, and R. Glaser, pp. 13-60. New York: W. H. Freeman & Co.
- Sokal, R. R., and F. J. Rohlf. 1969. *Biometry*. San Francisco: W. H. Freeman & Co.

- Solomon, I. 1987. Multi-auditor judgment/decision making research. *Journal of Accounting Literature* 6: 1-25.
- _____, and M. D. Shields. 1993. Judgment and decision research in auditing. In *Judgment and Decision Making Research in Accounting and Auditing*, edited by R. H. Ashton and A. H. Ashton, forthcoming. Cambridge, MA: Cambridge University Press.
- Sweller, J., and G. A. Cooper. 1985. The use of worked examples as a substitute for problem solving in learning algebra. *Cognition and Instruction* 2 (1): 59-89.
- Waller, W. S., and W. L. Felix, Jr. 1984. The auditor and learning from experience: Some conjectures. *Accounting, Organizations, and Society* 9 (3/4): 383-406.
- Willingham, D. B., M. J. Nissen, and P. Bullemer. 1989. On the development of procedural knowledge. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 15 (November): 1047-60.
- Winograd, T. 1975. Frame representations and the declarative-procedural controversy. In *Representation and Understanding: Studies in Cognitive Science*, edited by D. Bobrow and A. Collins, pp. 185-210. New York: Academic Press.

The Impact of the SEC's Segment Disclosure Requirement on Bid-Ask Spreads

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SYNOPSIS AND INTRODUCTION: Lev (1988) asserts that reducing inequities among investors should result in thicker markets with smaller bid-ask spreads and greater liquidity of securities. He claims that fuller disclosure should decrease inequities among investors by decreasing information asymmetries through equal access to information. It is argued that reducing information asymmetries should result in lower transaction costs as reflected in the bid-ask spread. This paper provides evidence on the effect of accounting disclosure on the size of the relative bid-ask spread. This study differs from previous studies in that it examines the effects of disclosure regulation on the market microstructure, not on earnings or risk predictability.

The SEC's 1970 segment disclosure requirement is chosen because of the added information content due to more finely partitioned data being presented. Previous research on segment disclosure showed improved predictive accuracy of earnings forecasts (Kinney 1971; Barefield and Comiskey 1975; Collins 1976; Baldwin 1984), an increase in price variability surrounding the release of 10-K reports, and a decrease in divergence of beliefs (Swaminathan 1991).

A random sample of firms listed on the NYSE as of fiscal year end 1970 is used. The results indicate that the relative bid-ask spread decreased more significantly in the period subsequent to the filing of the 1970 10-K reports for those firms reporting such information for the first time than for either a control group of firms

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or single-segment firms. For the experimental group, this downward shift in the relative bid-ask spread is shown to be a function of the number of segments reported. Overall, these findings provide limited evidence that the segment disclosure regulation may have an impact on the market microstructure as represented by bid-ask spreads.

Key Words: *Bid-ask spread, Transaction costs, Information asymmetry, Segment reporting.*

Data Availability: *All of the publicly available data in this study will be made available by the authors. The bid-ask data cost the authors a substantial amount of money to purchase. Further, this data had to be converted from hard-copy to diskette. The data will be made available after the authors finish a second research project using this data.*

THIS article is organized as follows. Section I describes the relationships among disclosure regulation, information asymmetries, and the bid-ask spread. Also, an overview of the SEC's segment reporting requirement is presented in this section. The hypotheses are formulated in section II. Section III discusses the sample selection criteria. The statistical methods employed are presented in section IV. The results are discussed in section V. Finally, a summary of the results and their implications is found in section VI.

I. Disclosure Regulation, Information Asymmetries, and the Bid-Ask Spread

In prior research, Hakansson (1981) discusses both laissez-faire and regulated timely disclosure environments and indicates a preference for the timely disclosure alternative. Verrecchia (1982) concludes that fuller disclosure results in increased informedness, and Gonedes (1980) agrees that disclosure regulation has the potential of reducing information asymmetries. This reduction of information asymmetries becomes important if it impacts the market microstructure. A resulting reduction in transaction costs, as represented by the bid-ask spread can be one such a benefit as discussed by Lev (1988).

Bagehot (1971) expands Demsetz's (1968) theory of securities' transaction costs and links information asymmetries to the bid-ask spread by differentiating between two different types of traders with whom dealers interact: informed traders and liquidity traders. The informed traders are presumed to have private, insider information and will always have the advantage over the liquidity traders because of their privileged information. The only way a dealer can gain is to transact with liquidity traders who have immediate liquidity requirements and are willing to incur transaction costs. Thus, Bagehot theorizes that dealers expect to incur losses on transactions with informed traders and realize gains on transactions with liquidity traders. Because trading with informed traders increases transaction costs as well as dealers' bid-ask spreads, informational asymmetries will lead to greater bid-ask spreads. (See also Glosten and Milgrom 1985, and Venkatesh and Chiang 1986.)¹

¹ Intuitively, one may conjecture that this adverse selection problem is prevalent only for thinly traded stocks, since a dealer can better offset his/her position if the stock is frequently traded. However, Stickel and Verrecchia (1992) provide evidence that the adverse selection problem is not prevalent only for thinly traded stocks. Rather, it is the interaction of other factors, such as price change, with volume that determines the dealer's ability to offset his/her position.

The link between an increase in disclosure regulation and a decrease in information asymmetries coupled with the link between a decrease in information asymmetries and smaller transaction costs provide the motivation for this study. Regulatory acts that require more valued information to be publicly provided should indirectly affect the size of the bid-ask spread through the resulting decrease in information asymmetries, which can gauge the regulatory goal of achieving equity in capital markets.

Two prior research studies, Morse and Ushman (1983) and Venkatesh and Chiang (1986), examine the *transitory* impact of information asymmetries on the bid-ask spread. Morse and Ushman (1983) find that the relative bid-ask spread widens on days with large absolute price changes. They infer an indirect relationship between information effects and relative bid-ask spreads via price changes. Venkatesh and Chiang (1986) find an empirical relationship between the bid-ask spread and nonroutine information announcements. The current study, however, is concerned with more *permanent* effects on the bid-ask spread.

To understand how disclosure regulation might cause more permanent effects on the bid-ask spread, a discussion of the spread and its components is provided. Stoll (1988, 1989) asserts that the bid-ask spread is comprised of three components: adverse information costs, inventory holding costs, and order processing costs. The adverse information component is a result of the dealer's concern that some traders have privileged information on which they trade. The inventory holding cost represents "a fee for bearing the risk of holding an inventory that is not optimal" (Stoll 1988, 22). The last component, order processing costs, includes brokerage firm back-office costs, floor brokerage, and clearing and settlement costs. These costs are reflected in the spread to the extent that they affect the specialist.

Other researchers do not necessarily share that view. For example, Garman (1976, 267) assumes no transaction costs for the specialist and does not consider the individual motivation of market agents; he only considers the inventory control aspects of relating prices to their inventories to avoid failure. Hasbrouck's (1988) empirical results support the theory that trading by informed investors can affect quote revisions, while conflicting evidence is found for an inventory control model. In a somewhat different type of analysis, Ho and Stoll (1981) employ dynamic programming to model the optimal bid and ask prices. Contrary to inventory control theories, they assert that the "spread is largely independent of the dealer's inventory position and depends on fundamental characteristics of the stock and the dealer" (1981, 62). More recently, Stoll (1989) provides empirical evidence that the adverse information component of the bid-ask spread is a large (43 percent) and relatively invariant proportion of the spread. George et al. (1991) estimate the adverse selection component to be as low as 8-13 percent of the quoted spread for daily data. Their findings, however, are restricted to small trades for firms on the NASDAQ market. These findings, confirming the existence of an adverse information component, suggest that a change in the adverse information component should have a direct impact on the size of the spread.²

To the extent that a regulatory act causes previously undisclosed valued information to be made public, the adverse information component should decrease permanently, or at least until that information is no longer valued or the regulatory act is rescinded. In other words, equal access to information by investors has been permanently increased. For a regulatory act that has resulted in increased valued information, the SEC's 1970 segment disclosure requirement

² The order processing and inventory holding cost components are not examined in this study. Excluding consideration of these types of costs should not affect the results for two reasons. First, these types of costs are considered to be more dealer-specific than firm-specific. Second, any changes in dealers' costs (systematic shifts) over time should not affect the results because of the use of a control group in the research design.

is chosen, since prior research by Kinney (1971, 1972), Collins (1975, 1976), Simonds and Collins (1978), Baldwin (1984), and Swaminathan (1991) indicates that segment disclosure reduces information asymmetries.³ The SEC requirements called for registrants to provide percentage of total sales and operating revenues and the contribution to income before income taxes and extraordinary items for each line of business that contributed a specific percentage (typically 10 percent or more) to total sales or income.⁴ The SEC further required that this line of business data be provided for each of the five prior years.

II. Hypothesis Formulation

The previous discussion leads to the following hypothesis (in its alternate form):

H1: Multisegment firms that did not publicly disclose segment data prior to 1970, but did subsequently, will have smaller relative bid-ask spreads following the disclosure of such information.

The relative bid-ask spread is measured by the difference between the ask and the bid prices divided by their average.⁵ Roll (1984) indicates that this measure of spread facilitates comparison across firms, and other researchers have employed it as well (Stoll 1978; Kaul and Nimalendran 1990). Demsetz (1968) and Benston and Hagerman (1974) find that the spread increases as the price of the security increases; however, this relationship is not proportional. Specifically, Benston and Hagerman (1974) find that as the price of a security doubles, the spread increases only 59 percent, *ceteris paribus*. Because of this dependency, the relative spread, rather than the spread, is used in the analysis. Moreover, the percentage change in price is included as a control variable to help assess whether changes or fluctuations in the denominator of the relative spread contribute to changes found in the intervention analysis.

The remaining hypotheses are dependent upon the results for the first hypothesis. A finding that relative bid-ask spreads decreased after segment data are disclosed leads us to test the effects of the following two explanatory variables: number of segments disclosed and size of the firm. The number of segments reported is expected to be related to the amount of reduction in information asymmetry. Swaminathan (1991) provides evidence that the decrease in divergence of beliefs due to segment disclosure is significantly related to the number of segments reported. Thus, as more segments are reported, the greater the chance that information asymmetries are being reduced. Firms that experience greater reductions in information asymmetry are expected to have greater decreases in their relative bid-ask spreads as reflected in the following hypothesis:

³ The Accounting Principles Board (APB) was the first regulatory body to formally advocate segment reporting in APB *Opinion No. 2*: "Disclosure of Supplemental Financial Data by Diversified Companies," which was issued in 1967 and only encouraged segment disclosure. The SEC also took the segment reporting issue under advisement and, in September 1968, issued a proposal requiring line of business disclosure on the S-1, S-7, Form 10, and 10-K filings. The requirements for the S-1, S-7, and Form 10 reports began in July 1969, and they became effective for the 10-K forms for all fiscal years ending after 30 December 1970. The relevant Securities Act of 1933 and 1934 releases are: Release No. 4988 (July 1969), Release No. 8650 (July 1969), and Release No. 9000 (October 1970). Forms S-1 and S-7 are used for the registration of new securities, while Form 10 is used for registration of securities on secondary markets.

⁴ Securities Act of 1934, Release No. 9000.

⁵ The relative spread = $\frac{\text{Ask} - \text{Bid}}{(\text{Ask} + \text{Bid})/2}$.

H2: The magnitude of the decrease in the relative spread is positively related to the number of segments reported, (NOSEGS).

NOSEGS is measured by counting the number of segments reported in Form 10-K.

Morse and Mucklow (1989) find evidence consistent with the hypothesis "that small and less frequently traded securities are more likely candidates for partial adjustment of prices to information." Consequently, if the prices of securities adjust only partially rather than fully to information, dealers should expect to lose more from trading with informed traders. This expectation stems from the assumption that traders with privileged information can gain from their trading on this knowledge until prices reflect that knowledge. Therefore, the informed traders of large firms are not expected to have as much time to gain from transactions based on their privileged information as do the informed traders of smaller and less frequently traded firms. Larger firms' securities are typically traded more frequently, and the frequency of trade affects the speed of adjustment to new information. Dealers should worry less about losing in trades with traders informed about larger companies because the market will more rapidly adjust to the trades being made on privileged information about the larger and more frequently traded stocks. As a result, the spreads for these larger firms should be lower than the spreads of smaller firms. This notion is also supported by Roll's (1984) empirical evidence that firm size is negatively related to estimated bid-ask spreads. Size of the firm is viewed as a mitigating variable in the downward adjustment of the relative bid-ask spread in response to disclosure of segment information. Larger firms with smaller initial relative spreads will have a smaller downward adjustment of the relative spread. Thus, the next hypothesis concerns whether the decrease in the relative spread is inversely related to the size of the firm.

H3: The magnitude of the decrease in the relative spread is inversely related to the size of the firm.

Firm size is measured by the log of total owners' equity. Data for this variable are obtained from the 10-K reports and Compustat P.C. Plus.

III. Sample Selection

We randomly selected 800 firms listed on the NYSE as of fiscal year-end 1970. These firms were then subjected to the following screening criteria:⁶ (1) bid-ask quotes listed on the Francis Emory Fitch Sheets; (2) price data listed on *Standard and Poor's Daily Stock Price Record*; (3) 1969 and 1970 10-K reports available; (4) December 31 fiscal year-end with 10-K date stamped during the period 2/21 through 4/9/1971; (5) S-1 and/or an S-7 not filed between 7/69 and 4/71; and (6) volume and return data on CRSP tapes. The fourth criterion in the screening process is added to limit the cost of purchasing data.⁷ The fifth criterion is necessary because segment information would have been required in these reports. Required data were available for 222 firms, as shown in Panel A of table 1.

These firms are divided into four groups. A quasi-experimental group consists of single-segment firms, which are defined as firms that did not disclose any segment data in their 1970 10-K reports (group 1). A control group consists of multisegment firms that voluntarily disclosed segment revenue and income data in their annual reports, 10-K reports, or in any regis-

⁶ A random selection process is used to obtain a manageable number of firms since the data are mostly manually collected.

⁷ The only known source for bid and ask quotations for firms listed on the NYSE during this period is the Francis Emory Fitch Company. The cost is \$25 per day for the entire NYSE.

tration statement or proxies filed with the SEC for fiscal year 1969 (group 2). A primary experimental group consists of multisegment firms with no segment disclosure of any kind prior to the filing of their 1970 10-K reports (group 3). A secondary experimental group consists of multisegment firms that disclosed only segment revenue data in their 1969 10-K reports (group 4).

The breakdown of the number of firms in each group is presented in Panel B of table 1. The above process is identical to Swaminathan's (1991) taxonomy except for the single-segment firms in the quasi-experimental group that were excluded from his analysis. Since this is the only group that contains single-segment firms, the firms in this group are inherently different from the firms in the other three groups. These single-segment firms may be **indirectly** affected by the increased information that some of the multisegment firms are making public for the first time. The additional data may provide information about the single-segment firms themselves and their competitors. Further, a distinction is now made public as to whether a firm is a multisegment or a single-segment firm. Thus, the first group is considered quasi-experimental due to the **indirect** effects that segment reporting **may** have on single-segment firms, even though these firms are not **directly** impacted by segment reporting.

The control group allows for checks in the stability of the time-series data. These firms have been disclosing segment information voluntarily prior to the SEC's requirements. Thus, any changes in the time-series for this group due to the SEC's mandatory segment reporting

Table 1
Sample Selection

<i>Panel A: Screening Procedures</i>	<i>No. of Firms</i>	<i>Panel B: Distribution of Sample into Groups</i>		
Random Sample	800	Quasi-Experimental Group	Single-segment firms	87
Not Dec. year-end	< 247>	Control Group	Firms already reporting segment revenues & income prior to 1970	41
Missing price data	< 13>			
Missing bid-ask quotes	< 25>	Experimental Group 1	Firms reporting segment information prior to 1970	44
Missing volume and return datano	< 34>			
Missing 10-K and/or annual report	< 81>	Experimental Group 2	Firms reporting solely segment revenue information prior to 1970	50
S-1 and/or S-7 filed	<159>			
SEC stamp date not between 2/21 and 4/31	< 19>	Total		222
Final sample	222			

requirements should be attributable primarily to the **indirect** effects of more information being provided for the first time by competitors. Changes detected in the control group may help in determining whether changes in the experimental groups are due to factors other than the **direct** effects of segment reporting.

Experimental group 1 includes firms that did not previously disclose segment information of any kind in prior years. Any changes found in the time-series parameters for this group may be attributed to the direct effects of segment reporting to the extent that these changes are not also observed for the control group. Experimental group 2 consists of firms that previously disclosed segment revenue data in 1969, but without providing other segment information. Examination of how this group is affected by more detailed disclosures allows the incremental information content of other types of segment data over revenue data to be assessed. The strongest comparison, however, is between the control group and experimental group 1.

To the extent that the firms in each group are inherently different from the firms in the other groups, the benefits of employing a control group may not be realized. An analysis of industry grouping by SIC code indicates that the firms in each group are represented by a wide variety of industries and not heavily concentrated in any particular industry. Further, differences in firm characteristics among groups, such as number of segments, firm size, and stock price are examined in the results section to assess whether the groups are relatively homogeneous or inherently different. Nevertheless, if any self-selection biases exist, the results may be affected.

IV. Method

To measure the change in the bid-ask spread, the event date is defined as the date the 1970 10-K reports are received and stamped by the SEC. The method used to assess the change in the relative bid-ask spread after initial disclosure of the segment data required by the SEC is a time-series intervention analysis. Wichern and Jones (1977, 332) discuss the benefits of using such an approach over a t-test or a nonparametric procedure to assess both the rate and nature of disturbances in a time-series where the data are serially dependent and nonstationary. In this approach, the single time-series data of relative bid-ask spreads are analyzed to determine if any interruptions (or shifts) in the time-series occur as a result of the segment reporting requirement.

The intervention analysis technique requires that an appropriate time-series model be identified, estimated, and diagnosed for each firm for the pre-event period. The entire time-series length is 127 weeks. One observation for each week, Wednesday, is used.⁸ The event (the SEC stamp date) can occur anywhere in a seven-week interval as specified in sample selection criterion four. To have at least 60 weeks in both the pre-event and post-event periods, 127 weeks of data are used. The series is modeled using the pre-event period only (approximately 60 weeks) since any large intervention effects can cause an incorrect model to be identified if the entire time-series (127 weeks) is used, as discussed by McCain and McCleary (1979). The autocorrelation functions (ACF) and partial autocorrelation functions (PACF) are examined until a model fits that causes the ACF and PACF to follow a white noise process. Each firm's model will have two components:

⁸ The Fitch company could not locate the Fitch sheets for week 110 in the time-series. We averaged weeks 109 and 111 as a substitute for week 110.

$$Y_{it} = \text{TSM}_i + \varepsilon_{it}, \quad (1)$$

where $Y_{it} = \log(\text{weekly relative spread for firm } i \text{ at time } t)$;
 $\text{TSM} = \text{vector of coefficients of time-series model for firm } i$; and
 $\varepsilon_{it} = \text{white noise for firm } i \text{ at time } t$.

The vector of coefficients of time-series models will vary across firms depending upon the model chosen. Two input variables, LVOL and PRVAR, which represent the log of the average weekly trading volume and the weekly price variability, are included in the above model when computing the cross-correlation functions.

Once an appropriate model is found for each firm, an intervention component and two input variables are added to the time-series model:

$$Y_{it} = \text{TSM}_i + \omega I_{it} + \beta_1 \text{LVOL}_{it} + \beta_2 \text{PRVAR}_{it} + \varepsilon_{it}, \quad (2)$$

where $Y_{it} = \log(\text{weekly relative spread for firm } i \text{ at time } t)$;
 $I_{it} = \text{the intervention component for firm } i \text{ at time } t$;
 $\text{TSM}_i = \text{vector of coefficients of time-series model for firm } i$;
 $\text{LVOL}_{it} = \log(\text{average weekly trading volume for firm } i \text{ at time } t)$;
 $\text{PRVAR}_{it} = \text{weekly price variability for firm } i \text{ at time } t$ ⁹; and
 $\varepsilon_{it} = \text{white noise for firm } i \text{ at time } t$.

The intervention component, I_{it} , is of primary concern in examining the first hypothesis. The other two input variables, LVOL and PRVAR, are added to complete the model since prior research has indicated that volume and variability in price are related to bid-ask spreads.¹⁰ If the intervention component adds to the predictive power of the model, its parameters will be statistically significant. McCain and McCleary (1979) discuss three transfer functions that can be examined: (1) an abrupt, constant change; (2) a gradual, constant change; and (3) an abrupt, temporary change. If segment reporting requirements achieve the objective of regulation as set forth by Lev (1988), a permanent decrease in the relative bid-ask spread is expected. Consequently, the appropriate transfer function to examine the hypothesis is an *abrupt, constant change* using a dummy variable where a 0 represents the pre-event period and a 1 represents the event and post-event periods.¹¹

The input component, LVOL, represents the log of the average weekly trading volume for each week in the time-series. The log transformation is used due to non-normality of the volume data. This variable is considered to be an important input variable since a strong inverse relationship has been found between the bid-ask spread and the volume of trade (Demsetz 1968; Benston and Hagerman 1974; Epps 1976; Copeland and Galai 1983; Karpoff 1986). Further studies by Benston and Hagerman (1974), Ho and Stoll (1981), Copeland and Galai (1983), and Morse and Ushman (1983) find that the spread is a function of the amount of uncertainty regarding the true price of the stock, or the variance of stock returns; the greater the uncertainty, the larger the spread. Thus, LVOL and PRVAR are included as input variables so that

⁹ The standard deviation of returns is used rather than the standard deviation of price due to the impact of stock dividends and stock splits on the price level, which are not adjusted for on the CRSP tapes. Chopra (1992) discusses the appropriateness of using the return variability as a proxy for variability of price.

¹⁰ We would like to acknowledge one of the anonymous reviewers for suggesting that we include these two input variables.

¹¹ The intervention analysis confirms the appropriateness of this expectation. The other methods (gradual, constant, and abrupt, temporary changes) are examined without yielding any significant results.

any shifts found in the time-series can be examined after taking into account any effects that trading volume and price variability may have on the spread over time.

An investigation of any interruptions found in the time-series, as represented by ω , is conducted using a cross-sectional regression model. To represent the change in the relative bid-ask spread from the pre- to post-event period, the coefficient, ω adjusted for standard error, is used. This coefficient is negative, representing a decrease in the spread for 189 of the firms, and positive for the remaining 33 companies. To interpret the estimated coefficients more easily, the dependent variable is first multiplied by -1. Thus, the following model is analyzed:

$$\hat{\omega} = \alpha + \Psi (\text{explanatory variables}) + \varepsilon, \quad (3)$$

where $\hat{\omega}$ = estimated regression coefficient from intervention analysis deflated by the standard error of the estimate * -1;

α and Ψ = regression coefficients;

explanatory variables = {OE, NOSEGS, CHPRICE, CHOE};

where

OE = log of owners' equity as of the 1970 10-K reports;

NOSEGS = number of segments reported in the 1970 10-K report;

CHPRICE = log of the percentage change in average daily price from the pre- to post-event period; and

CHOE = log of the percentage change in owners' equity from the 1969 to the 1970 10-K reports.

The percentage change in price is included as a control variable to help assess whether changes or fluctuations in the denominator of the relative spread contribute to changes found in the intervention analysis. The percentage change in owners' equity is included as a control variable to examine if any changes in firm size from the pre- to post-event period may be affecting the results. Also, the number of competing dealers has been found to be associated with the relative spread (Benston and Hagerman 1974). Benston and Hagerman's study examines OTC firms that have multiple dealers. The firms in this study are NYSE firms that have specialists and not multiple dealers. Thus, this variable is not included in this study since it would be a constant of one.

V. Results

Descriptive Statistics

The weekly relative spreads for the market index, as calculated from the Fitch Sheets by computing the average spread for all firms on the NYSE, are plotted over time in figure 1 for the 127-week period examined in this study. This figure shows that the relative spread for the market index is decreasing over time. Also, the absolute spreads (ask-bid) for the market index of NYSE firms are plotted over time in figure 2. As evidenced in figure 2, the average of the absolute spreads is also clearly decreasing over time. This similarity of the trend between figures 1 and 2 indicates that using the average of the bid and ask quotations as a deflator in the relative spread calculation is probably not the only force behind any changes occurring in the relative spread. The frequencies of the relative bid-ask spread data are examined and are not found to follow a normal distribution. After making a log transformation, the data become more symmetrical.

Figure 1
Market Relative Spread over Time

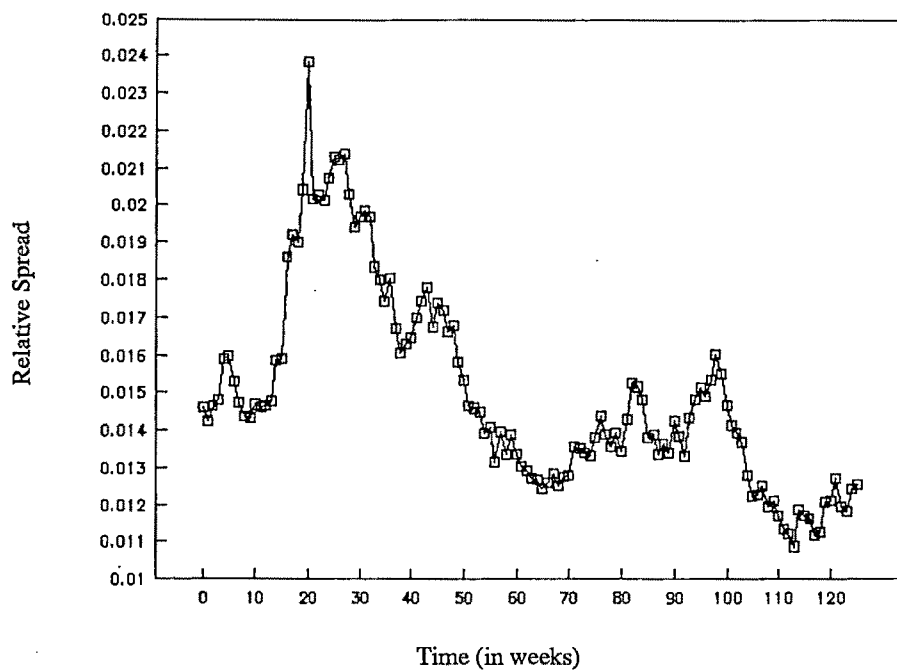
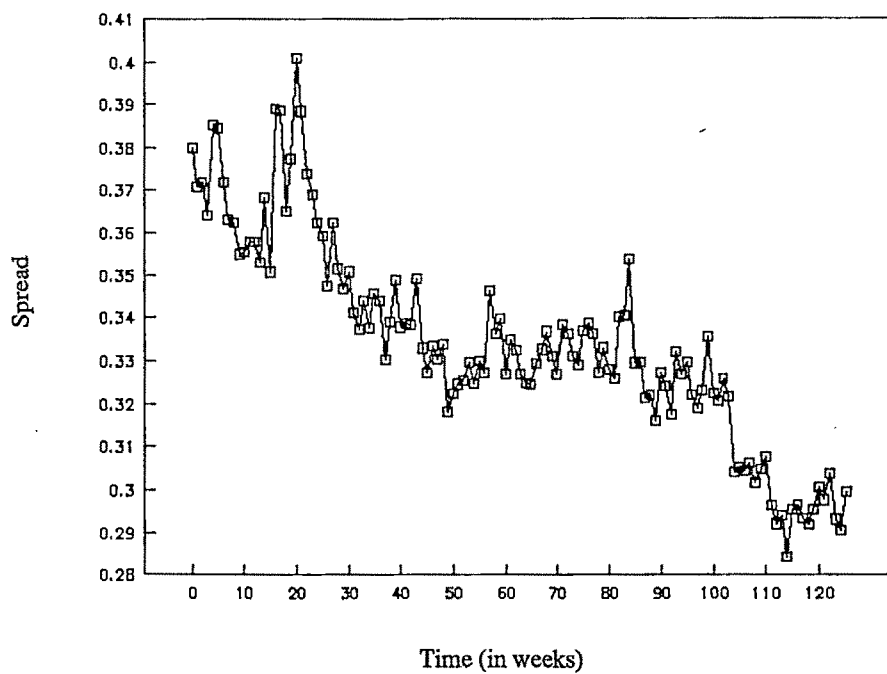


Figure 2
Market Spread over Time



Descriptive statistics are provided in Panel A of table 2 for the following variables by group: number of segments, total owners' equity, and stock price as of the 1970 10-K stamp date. ANOVA tests are conducted to determine whether differences among groups exist with respect to these variables.¹² Single-segment firms are excluded when testing the number of segments. No significant differences among the groups are found for the number of segments or the price as of the 1970 10-K date. A significant difference is found, however, among the groups for owners' equity. The single-segment firms appear to be substantially smaller than the multisegment groups of firms. Any effects due to differences in size are examined when testing hypothesis 3.

The mean and median relative spreads of the raw data for each group are presented for the pre- and post-disclosure periods in Panel B of table 2. In each case, the average relative spread shifts downward from the pre- to post-disclosure period. At the individual firm level, the means of the relative bid-ask spreads are calculated for the pre- and post-disclosure periods. The percentage changes in mean are calculated from pre- to post-disclosure for each firm. The percentage changes are averaged for each of the groups, and the means, medians, and standard deviations are reported in Panel B of table 2. Within the multisegment groups, the results are as expected; those firms reporting segment data for the first time have the greatest percentage decrease in median (32.5%), followed by those groups previously reporting segment revenue data (22.9%). Finally, the control group has the smallest percentage decrease in median (21.9%). The single-segment firms have a decrease of 18.1%, which is lower than the other three groups.¹³

Test of Hypothesis 1

After identifying what is deemed to be an appropriate ARIMA model for each firm using equation (1) over the pre-event period (approximately 60 weeks), the intervention component and the input variables, LVOL and PRVAR, are added to the model as in equation (2) for the entire 127-week period. Table 3 provides descriptive statistics of the time-series models. Panel A lists the most common models identified for each firm and their frequencies. Within each group, the log-transformed data resulted in approximately 40 percent of the firms needing no corrections or lag variables. However, the first difference models identified for 19 of the firms in Panel A of table 3 confirm the need to use intervention analysis over t-tests. Further, roughly one-half of the firms categorized as "other models" have a first difference component. Panel B lists descriptive statistics indicating the proportion of firms in each group with significant coefficients for the input variables, LVOL and PRVAR. In every case but one, fewer than half of the firms in each group experienced a significant coefficient in one of these variables. Overwhelmingly, the coefficients were negative for LVOL and positive for PRVAR, consistent with prior studies by Benston and Hagerman (1974) and Copeland and Galai (1983), among others.

Panel C of table 3 presents descriptive statistics regarding the frequency of significant shifts at 0.10 or better (two-tailed test) for the intervention component, I_{it} . A binomial test is conducted to determine if the number of firms with significant shifts is statistically greater than chance (50 percent) (Siegel 1956). The results indicate that for all groups the number of firms with abrupt, constant shifts is statistically greater than chance.

¹² A Kruskal-Wallis test of distributions across groups is used to examine if the assumption of equal variances is met for the ANOVA analysis. The results indicate that the assumption of equal variances is valid for number of segments and 1970 stock price. The variance is not uniform across groups for owners' equity. Pairwise t-tests with unequal variances confirm the ANOVA results that owners' equity varies among groups.

¹³ The medians are discussed due to the non-normality of the raw data.

Table 2
Descriptive Statistics

PANEL A: ANOVA Tests of Differences Among Groups

	<i>Group 1 Single Segment</i>	<i>Group 2 1969 Revenue & Income</i>	<i>Group 3 No 1969 Segment Data</i>	<i>Group 4 1969 Revenue</i>	<i>Pr > F</i>
Number of Segments					
Mean	1	4.1	3.8	3.7	0.49
Std Dev	(0)	(1.7)	(1.8)	(1.4)	
Median	1	4.0	3.0	3.5	
*Owners' Equity (000's)					
Mean	\$ 197,649	\$ 486,306	\$ 337,377	\$ 256,250	0.04
Std Dev	(259,737)	(567,805)	(935,971)	(361,752)	
Median	91,734	206,822	88,178	142,936	
Price at 10-K Date					
Mean	\$ 35.4	\$ 35.7	\$ 40.6	\$ 38.4	0.83
Std Dev	(23.0)	(22.3)	(54.2)	(30.8)	
Median	28.4	28.0	27.7	30.6	
n	87	41	44	50	

*ANOVA test is run using the log-transformed data.

PANEL B: Comparison of Pre- vs. Post-Event Relative Spreads

	<i>Group 1 Single Segment</i>	<i>Group 2 1969 Revenue & Income</i>	<i>Group 3 No 1969 Segment Data</i>	<i>Group 4 1969 Revenue</i>
Mean Pre-1970 10-K	0.0157	0.0153	0.0167	0.0161
(Std Dev)	(0.007)	(0.010)	(0.008)	(0.008)
Median	0.0138	0.0137	0.0163	0.0140
Mean Post-1970 10-K	0.0128	0.0126	0.0128	0.0122
(Std Dev)	(0.006)	(0.010)	(0.007)	(0.007)
Median	0.0113	0.0107	0.0110	0.0108
Avg % Change in Mean	-18.4%	-17.3%	-22.5%	-23.6%
(Std Dev)	(15.3)	(18.8)	(16.9)	(14.5)
% Change in Median	-18.1%	-21.9%	-32.5%	-22.9%
n	87	41	44	50

Table 3
Time-Series Analysis-Descriptive Statistics

PANEL A: Time-Series Models Identified

	<i>Group 1 Single Segment</i>	<i>Group 2 1969 Revenue & Income</i>	<i>Group 3 No 1969 Segment Data</i>	<i>Group 4 1969 Revenue</i>
No corrections	40	15	21	20
AR(1)	11	7	9	6
AR(2)	6	3	1	1
AR(1,2)	7	2	1	4
AR(3)	2	2	3	2
MA(1)	0	1	1	0
1st difference	0	2	0	0
1st difference w/MA(1)	6	4	3	4
Other models	15	5	6	13
TOTAL	87	41	44	50

PANEL B: Percentage of Firms with Significant Coefficients

	<i>Group 1 Single Segment</i>	<i>Group 2 1969 Revenue & Income</i>	<i>Group 3 No 1969 Segment Data</i>	<i>Group 4 1969 Revenue</i>
LVOL	32%	32%	45%	42%
PRVAR	47%	34%	30%	54%
LVOL & PRVAR	18%	20%	14%	22%
n	87	41	44	50

$$Y_{it} = TSM_i + \omega I_{it} + \beta_1 LVOL_{it} + \beta_2 PRVAR_{it} + \varepsilon_{it}$$

where

Y_{it} = log(weekly relative spread for firm i at time t);
 I_{it} = the intervention component for firm i at time t ;
 TSM_i = vector of coefficients of time-series model for firm i ;
 $LVOL_{it}$ = log(average weekly trading volume for firm i at time t);
 $PRVAR_{it}$ = weekly price variability for firm i at time t ; and
 ε_{it} = white noise for firm i at time t .

(Continued)

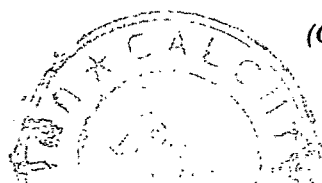


Table 3 (Continued)
Intervention Analysis

PANEL C: Descriptive Statistics

	<i>Group 1 Single Segment</i>	<i>Group 2 1969 Revenue & Income</i>	<i>Group 3 No 1969 Segment Data</i>	<i>Group 4 1969 Revenue</i>
n	87	41	44	50
% of firms with significant shifts	64%	73%	73%	66%
% of firms with significant negative shifts	61%	68%	71%	66%
Binomial 1-tail p-value	0.0051*	0.0025*	0.0021*	0.0170**
Mean Shift (Std Dev)	-0.165 (0.176)	-0.174 (0.200)	-0.245 (0.211)	-0.209 (0.173)

PANEL D: T-tests of means

<i>GROUPS</i>	<i>1-TAIL T-Value</i>	<i>1-TAIL P-Value</i>
1 vs. 2	-0.26 (2-tail)	0.81 (2-tail)
1 vs. 3	-2.32	0.01*
1 vs. 4	-1.44	0.08***
2 vs. 3	-1.60	0.06***
2 vs. 4	-0.91	0.18
3 vs. 4	0.90	0.18

*significant at $\alpha = 0.01$ or better;

**significant at $\alpha = 0.05$ or better;

***significant at $\alpha = 0.10$ or better.

The coefficient ω represents the shift parameter in the intervention analysis. The means and standard deviations for this coefficient are also presented by group in Panel C of table 3. For all four groups, the shift in the time-series is downward. Within the multisegment groups, the results are as expected; those firms reporting segment data for the first time have the greatest decrease (-0.245), followed by those firms previously reporting only segment revenue data (-0.209). The control group has the smallest decrease (-0.174) of the multisegment firms. The single-segment firms have a decrease of 0.165, which is lower than each of the multisegment groups.

T-tests are conducted to determine whether the mean shifts reported in Panel C of table 3 are statistically different from one another. These results are shown in Panel D of table 3. One-tailed tests are conducted to compare each pair of groups, except for the comparison of groups 1 and 2 where the direction is not apparent. The strongest statistical difference ($p=0.01$) is between groups 1 and 3, and the second strongest statistical difference ($p=0.06$) is between groups 2 and 3. The results indicate that firms in the experimental group reporting segment data for the first time in their 1970 10-K reports have a significantly greater downward shift in their time-series than do firms in either the single-segment group or the control group. Further, firms in the experimental group previously reporting only segment revenue data have a significantly greater downward shift in their time-series than do the single-segment firms.¹⁴

The results of the intervention analysis reported in table 3 provide some support for H1: the firms in the experimental group most crucial to this study, those firms not previously reporting segment data, have the greatest downward shift in their time-series parameters. This downward shift in the time-series is shown to be greater than the downward shifts observed for both the control group (those firms previously reporting segment information) and the group of single-segment firms. Thus, the most important comparison, between the first experimental group (group 3) and the control group, is statistically significant ($p=0.06$) in the hypothesized direction. Further, this downward shift is shown to be abrupt and constant rather than transitory in nature.¹⁵ Also, the second experimental group of firms, group 4, is shown to have a significantly greater downward shift than does the single-segment group of firms. The only significant differences not found are between the single-segment firms and the control group, where no predictions or hypotheses are made. This comparison is analyzed for completeness in the pairwise comparison. Also, no significant differences are found between groups 2 and 4, and 3 and 4. Group 4, the experimental group of firms previously reporting segment revenue data, is included to assess the incremental information content of other types of segment data over revenue data. The results are inconclusive for the group of multisegment firms pre-

¹⁴ To determine whether the results are affected by the length of the pre- and post-disclosure event periods, the same intervention analysis is conducted for a shorter period, 40 weeks pre and 40 weeks post. The results obtained confirm the results reported using the 60 weeks pre and 60 weeks post 1970 10-K announcement date.

Conversely, to determine that the results obtained are not driven by some systematic changes occurring with respect to the market microstructure, the same intervention analysis is conducted using a dummy event period. The first 30 weeks (weeks 1-30) are treated as a pre-event period, while the second 30 weeks (weeks 31-60) are treated as a post-event period. The results obtained are substantially different from and not confirmatory of the results reported using the 60 weeks pre- and post-1970 10-K announcement date (the binomial test did not indicate that the number of firms with significant shifts is greater than chance for any group). These results, in conjunction with the use of a control group in the research design, strengthen the conclusions drawn regarding the effects of segment reporting on the change in the relative bid-ask spread.

¹⁵ The results from regressing firm's relative bid-ask spread on the relative bid-ask spread for the market, a time-period indicator that equals 0(1) pre- (post-) 1970 10-K report, and an interaction term for these regressors are also consistent with the intervention analysis. The only group with significant shifts is the experimental group of firms reporting segment data of any kind for the first time in their 1970 10-K report. (Note this is consistent since the market model approach implicitly controls for market swings or changes.)

viously reporting segment revenue data; no significant differences are found between this group and either the control group or the main experimental group of firms not previously reporting segment data of any kind prior to their 1970 10-K reports.

Tests of Explanatory Variables—Hypotheses 2 and 3

This section investigates whether the magnitude of changes found in the previous analysis are a function of the number of segments reported, NOSEGS, and size, as measured by owners' equity, OE. Further, the percentage change in average price, CHPRICE, is examined to determine whether any changes and/or fluctuations in the denominator of the relative spread are affecting the shifts in the time-series; the percentage change in owners' equity, CHOE, is examined to determine if the firms remained relatively stable from the pre- to post-event period. Upon examining the distributions of the independent variables, OE, CHPRICE, and CHOE are not found to follow a normal distribution. The data become normally distributed after the variables are transformed using logarithms. Prior to transforming CHPRICE and CHOE, a constant is added to the data so that all numbers become positive. A correlation matrix is examined to determine if any of the variables have high collinearity, which could affect the coefficients in a multiple regression analysis. These results are presented in Panel A of table 4. OE and NOSEGS are significantly correlated. This relationship will be considered when interpreting the results.

In Panel B of table 4, paired comparison t-tests are used to examine whether the changes in size and price from pre to post are significantly different from zero. As indicated by the t-tests, OE does appear to change from pre to post for three of the four groups and that is why CHOE is included as an explanatory variable. The median change in owners' equity is fairly uniform across the four groups, an increase of approximately four percent. A one-way ANOVA test indicates that the change in owners' equity does not vary significantly across groups. The change in price from pre to post also appears to be significantly different from zero as evidenced by table 4. A one-way ANOVA indicates that the percentage change in price is not uniform across groups. The experimental groups experience the greatest price increases, while the control group and single-segment groups experience smaller price increases from the pre- to post-event periods. These differential effects across groups are examined by including this variable in the explanatory model.

The results of the regressions are presented by group in table 5. An examination of the residuals and a Shapiro-Wilk test of normality indicate that the regression residuals are normally distributed for each group. The squared residuals are also examined to determine if they are independent of the regressors, and no significant correlations are found. The squared residuals are found to be significantly correlated with the dependent variable indicating that heteroscedasticity may be a problem. The regressions reported in table 5 are the results corrected for heteroscedasticity.

Number of Segments. NOSEGS is excluded from the regression for the single-segment firms since, by definition, this variable is 1. The results in table 5 indicate that NOSEGS is not significant for either the control group or experimental group 2. NOSEGS is found to be significant for the experimental group of firms disclosing segment data for the first time in their 1970 10-K reports. The coefficient is in the expected direction: the greater the number of segments reported, the greater the decrease in the relative spread. An interpretation of these results is that the downward shifts found for those firms previously reporting *any* type of segment data are not a function of the number of segments reported in the 1970 10-K reports, while the downward shifts for those firms disclosing segment data of any type for the first

Table 4
Explanatory Variables—Descriptive Statistics

PANEL A: Pearson Correlation Coefficients

	<i>OE</i>	<i>NOSEGS</i>	<i>CHPRICE</i>	<i>CHOE</i>
<i>OE</i>	1.0			
<i>NOSEGS</i>	0.274*	1.0		
<i>CHPRICE</i>	-0.077	-0.057	1.0	
<i>CHOE</i>	0.047	-0.061	-0.065	1.0

OE = log of owners' equity as of the 1970 10-K reports;
NOSEGS = number of segments reported in the 1970 10-K report;
CHPRICE = log of the percentage change in average weekly stock price from the pre- to post-event period;
CHOE = log of the percentage change in owners' equity from the 1969 to the 1970 10-K reports.

*significant at 0.01 or better

PANEL B: Tests of Changes in Control Variables

	<i>Group 1 Single Segment</i>	<i>Group 2 1969 Revenue & Income</i>	<i>Group 3 No 1969 Segment Data</i>	<i>Group 4 1969 Revenue</i>	<i>ANOVA Pr>F</i>
CHANGE IN OWNERS' EQUITY:					
T-test of change from pre- to post-event using paired comparisons:					
	0.0001	0.0060	0.0800	0.4000	
Percentage change in owners' equity from 1969 10-K to 1970 10-K:					
Mean (Standard Deviation)	0.047 (0.07)	0.062 (0.09)	0.064 (0.50)	0.021 (0.18)	0.16
Median	0.044	0.047	0.043	0.043	

CHANGE IN PRICE:

T-test of change from pre- to post-event using paired comparisons:

0.0001	0.0001	0.0001	0.0001
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Percentage change in average price from pre-1970 10-K to post-1970 10-K:

Mean (Standard Deviation)	0.224 (0.33)	0.111 (0.25)	0.304 (0.34)	0.247 (0.28)	0.02
Median	0.180	0.150	0.260	0.200	
n	87	41	44	50	

The ANOVA test is conducted on the log transformed data. The paired comparisons t-tests, means, standard deviations, and medians reported are based on the raw data.

Table 5
Results of the Analysis Using the Explanatory Model

Regressions by Group:				
	<i>Group 1 Single Segment</i>	<i>Group 2 1969 Revenue & Income</i>	<i>Group 3 No 1969 Segment Data</i>	<i>Group 4 1969 Revenue</i>
Intercept	0.50	3.09	1.53	1.00
NOSEGS: β_1				
estimate	Not Applicable	-0.09	0.22	0.03
std error		0.13	0.12	0.14
T-Value		-0.74	1.81	0.22
2-tail p-value		0.23	0.04**	0.41
OE: β_2				
estimate	0.11	0.06	-0.17	0.02
std error	0.10	0.13	0.25	0.21
T-Value	1.11	0.46	-0.67	0.09
2-tail p-value	0.13	0.32	0.25	0.47
CHPRICE: β_3				
estimate	6.17	6.24	5.85	5.66
std error	0.57	0.56	1.14	1.03
T-Value	10.76	11.07	5.16	5.50
2-tail p-value	0.0001*	0.0001*	0.0001*	0.0001*
CHOE: β_4				
estimate	0.18	7.48	0.79	-0.37
std error	1.95	1.74	0.41	0.07
T-Value	0.09	4.29	1.94	-5.32
2-tail p-value	0.46	0.0001*	0.03**	0.0001**
Adjusted R ²	0.54	0.59	0.38	0.36

*significant at $\alpha = 0.01$ or better; **significant at $\alpha = 0.05$ or better

Explanatory Model: $\hat{\omega} = \alpha + \beta_1 \text{NOSEGS} + \beta_2 \text{OE} + \beta_3 \text{CHPRICE} + \beta_4 \text{CHOE} + \varepsilon$

where

$\hat{\omega}$ = estimated regression coefficient from intervention analysis deflated by the standard error of the estimate * -1;

NOSEGS = number of segments reported in the 1970 10-K report;

OE = log of owners' equity as of the 1970 10-K reports;

CHPRICE = log of the percentage change in average daily price from the pre- to post-event period; and

CHOE = log of the percentage change in owners' equity from the 1969 to the 1970 10-K reports.

time may be a function of the number of segments reported as exhibited by the significant regression coefficient for NOSEGS.

Size. The coefficient for the size proxy, OE, is not significant in any of the regression models reported in table 5, indicating that the magnitude of shifts in the relative spread is not a function of the size of the firm at a given point in time. Because of the correlation between OE and NOSEGS, the regressions are run (the results are not reported) without OE to determine if any impact on the remaining regressors is found. The results are virtually identical, with or without OE.¹⁶ While these findings do not support H3, they are not contradictory to Roll's (1984) empirical evidence that firm size is inversely related to estimated bid-ask spreads. Correlation analysis between firm size and the relative spread as of the 1970 10-K reports indicate that the two variables are significantly inversely related at $p=0.01$, consistent with Roll. Size is not found to be a significant factor, however, affecting the *magnitude* of the shift in the relative spread from the pre- to post-event period. These results provide no evidence that size is a mitigating variable, as expected, in the downward shift in the relative spread as a result of segment reporting.¹⁷

CHOE is not found to be significant for the single-segment firms; however, a significant relationship is found for the multisegment groups. The downward shifts in the coefficients for the multisegment firms do appear to be a function of a change in size. The coefficients are positive for the control group and experimental group 1, indicating that the larger the increase in size, the greater the downward shift in the relative spread; however, the converse is true for experimental group 2. These changes cannot necessarily be attributed to greater changes in the price of the stock, however, since CHPRICE and CHOE are not found to be correlated.

Change in Price. As shown in table 5, the percentage change in price is significant for all four groups and thus appears to be strongly related to the shift in the time-series. These results indicate that firms with greater increases in their average price from pre- to post-disclosure have greater decreases in their time-series parameters. The relatively higher adjusted R²s for the single-segment firms and control group of firms indicate that more variability is explained by the estimated regression models for these two groups than for the experimental groups. Consequently, the change in price is interpreted to be a less important explanatory variable for the experimental groups of firms than for the control group or single-segment firms as evidenced by less variability explained by the regression model estimates.

VI. Summary and Future Research Implications

The intervention analysis indicates that those firms reporting segment data for the first time in their 1970 10-K reports have a significantly greater downward shift in their relative bid-ask spread time-series than do either the firms in the control group previously reporting both segment revenue and income information or the single-segment firms. Further, these downward shifts are characterized as abrupt and constant rather than transitory. For this particular group of firms, the magnitude of these downward shifts in the time-series is shown to be an increasing function of the number of segments reported, consistent with Swaminathan's (1991) finding of a positive relationship between the number of segments reported and decreases in divergence of beliefs. Changes in price appear to be an important explanatory variable for all

¹⁶ In addition, the regressions are run without NOSEGS to determine if the coefficient of OE is affected. No changes occur.

¹⁷ Alternative proxies for size are also examined: log of total assets and log of market value of common stock outstanding. The results do not change qualitatively.

groups. Specifically, firms with greater increases in their average price from pre to post have greater decreases (downward shift) in their relative time-series parameters; however, the change in price explains less variability in the estimated regression models for the experimental groups. After taking into account price changes, change in size also appears to be a factor for the multisegment firms.

As with all event studies, isolating the effects of an event can be difficult. By employing the use of a control group in the research design, we have tried to mitigate extraneous events. To the extent our study has not properly screened or controlled for such events, our conclusions are limited. For example, the incremental magnitude of shift in the relative bid-ask spread time-series found in this study for the experimental group might be caused by an increase in the number of analysts following this group of firms or in press coverage, or a combination of the two. This relationship is not examined in this study; however, Swaminathan's (1991) study of segment reporting found that both his control and experimental groups of firms experienced a small *decrease*, 3.6% and 1.9% respectively, from May 22, 1970, to May 21, 1971, in the average number of analysts following the firms. Thus, a systematic change in the information environment, such as an increase in the number of analysts following the experimental groups, is most likely not a driving force.

Overall, these findings represent evidence that actions taken by regulators may have some impact on the market microstructure. Future researchers may wish to use the effect of regulators' actions (i.e., new pronouncements) on the market microstructure as a means of determining the value of the new requirement. This paper has used one component of the market microstructure—the relative bid-ask spread. Lev (1988) contends, however, that another benefit of disclosure regulation should be thicker markets, as evidenced by the volume of trade. While volume of trade was used as a control variable in this study, the joint effects of disclosure regulation on the bid-ask spread and the volume of trade may be an avenue for further research.

References

- Bagehot, W. 1971. The only game in town. *Financial Analysts Journal* 27 (March/April): 22.
- Baldwin, B. A. 1984. Segment earnings disclosure and the ability of security analysts to forecast earnings per share. *The Accounting Review* 59 (July): 376-89.
- Barefield, R. M., and E. E. Comiskey. 1975. Segmental financial disclosure by diversified firms and security prices: A comment. *The Accounting Review* 50 (October): 818-21.
- Benston, G. J., and R. Hagerman. 1974. Determinants of bid-ask spreads in the over-the-counter market. *Journal of Financial Economics* 1 (January/February): 353-64.
- Chopra, N. 1992. A model of price variability and trading volume: The case of odd-lot trading. Working paper, Temple University, Philadelphia, PA.
- Collins, D. W. 1975. SEC Product-line reporting and market efficiency. *Journal of Financial Economics* 2 (June): 125-64.
- _____. 1976. Predicting earnings with sub-entity data: Some further evidence. *Journal of Accounting Research* 14 (Spring): 163-77.
- Copeland, T., and D. Galai. 1983. Information effects on the bid-ask spread. *Journal of Finance* 38 (December): 1457-69.
- Demsetz, H. 1968. The costs of transacting. *Quarterly Journal of Economics* 82 (February): 33-53.
- Epps, T. W. 1976. The demand for brokers' services: The relation between security trading volume and transaction cost. *The Bell Journal of Economics* 7 (Spring): 163-94.
- Garman, M. B. 1976. Market microstructure. *Journal of Financial Economics* 3: 257-75.
- George, T. J., G. Kaul, and M. Nimalendran. 1991. Estimation of the bid-ask spread and its components: A new approach. *The Review of Financial Studies* 4: 623-56.

- Glosten, L. R., and P. R. Milgrom. 1985. Bid, ask, and transaction prices in a specialist market with heterogeneously informed traders. *Journal of Financial Economics* 14 (March): 71-100.
- Gonedes, N. J. 1980. Public disclosure rules, private information-production decisions, and capital market equilibrium. *Journal of Accounting Research* 18 (Autumn): 441-76.
- Hakansson, N. H. 1981. On the politics of accounting disclosure and measurement: An analysis of economic incentives. *Journal of Accounting Research* 19 (Supplement): 1-35.
- Hasbrouck, J. 1988. Trades, quotes inventories, and information. *Journal of Financial Economics* 22: 229-52.
- Ho, T., and H. R. Stoll. 1981. Optimal dealer pricing under transactions and return uncertainty. *Journal of Financial Economics* 9: 47-73.
- Karpoff, J. M. 1986. A theory of trading volume. *Journal of Finance* 41 (December): 1069-87.
- Kaul, G., and M. Nimalendran. 1990. Bid-ask errors or market overreaction? *Journal of Financial Economics* 28: 67-93.
- Kinney, W. R. 1971. Predicting earnings: Entity versus sub-entity data. *Journal of Accounting Research* 9 (Spring): 127-36.
- . 1972. Covariability of segment earnings and multisegment company returns. *The Accounting Review* 47 (April): 339-45.
- Lev, B. 1988. Toward a theory of equitable and efficient accounting policy. *The Accounting Review* 63 (January): 1-22.
- McCain, L., and R. McCleary. 1979. The statistical analysis of the simple interrupted time-series quasi-experiment. In *Quasi-Experimentation: Design and the Analysis Issues for Field Setting*, edited by T. Cook and D. Campbell. Boston: Houghton-Mifflin Co.
- Morse, D., and N. Ushman. 1983. The effect of information announcements on the market microstructure. *The Accounting Review* 58 (April): 247-58.
- , and B. Mucklow. 1989. Structural characteristics of autocorrelations in individual stock returns. Working paper, Cornell University.
- Roll, R. 1984. A simple implicit measure of the effective bid-ask spread in an efficient market. *Journal of Finance* 39 (September): 1127-39.
- Siegel, S. 1956. *Nonparametric Statistics for the Behavioral Sciences*. New York: McGraw-Hill.
- Simonds, R. R., and D. Collins. 1978. Line of business reporting and security prices: An analysis of an SEC disclosure rule: Comment. *Bell Journal of Economics* 9 (Autumn): 646-58.
- Stickel, S. E., and R. E. Verrecchia. 1992. Price behavior when expectations are conditioned over trading volume. Working paper presented at The University of Pennsylvania's Accounting Workshop.
- Stoll, H. R. 1978. The pricing of security dealer services: An empirical study of NASDAQ stocks. *Journal of Finance* 33 (September): 1153-72.
- . 1988. Portfolio trading. *The Journal of Portfolio Management* 14 (Summer): 20-24.
- . 1989. Inferring the components of the bid-ask spread: Theory and empirical tests. *Journal of Finance* 44 (March): 115-34.
- Swaminathan, S. 1991. The impact of SEC mandated segment data on price variability and divergence of beliefs. *The Accounting Review* 66 (January): 23-41.
- Venkatesh, P., and R. Chiang. 1986. Information asymmetry and the dealer's bid-ask spread: A case study of earnings and dividend announcements. *Journal of Finance* 41 (December): 1089-1102.
- Verrecchia, R. E. 1982. The use of mathematical models in financial accounting. *Journal of Accounting Research* 20 (Supplement): 1-42.
- Wichern, D. W., and R. H. Jones. 1977. Assessing the impact of market disturbances using intervention analysis. *Management Science* 24 (November): 329-37.

Auditor Switching and Conservatism

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SYNOPSIS AND INTRODUCTION: The relation between audit opinions and auditor switching has received considerable attention in recent years. Chow and Rice (1982) report a positive association between a firm's propensity to switch auditors and the receipt of a qualified opinion in the year prior to the switch.¹ However, firms that switch auditors do not seem to receive "improved" opinions in the year following the switch (Chow and Rice 1982; Smith 1986). Despite this evidence, the Securities and Exchange Commission (e.g., Release No. 33-6594 [1985] and Financial Reporting Release No. 34 [1989]) and the popular financial press (e.g., Power 1984) continue to express concerns about opinion shopping.

This study focuses on the auditor's opinion formulation process for switching and non-switching clients in the year prior to the switch. In particular, it examines the possibility that auditor switches are triggered not by the receipt of qualified opinions, but by auditors' use of conservative judgments for some clients. While conservatism refers to a number of accounting and auditing issues, the overall conservatism of the auditor is assumed to be reflected in a tendency to issue qualified opinions. An ordered probit model of the qualification decision is estimated with different threshold values for prospective switchers and non-switchers measuring different judgments applied to the two groups of clients. The results support the hypothesis that threshold values for switchers are significantly lower (more conservative) than those for non-switchers. Further analysis of switching patterns suggests that when qualified opinions are based on conservative standards, the switching rate is higher than when average standards are applied.

The observed conservatism could be the auditor's reaction to negative private information gathered during the audit that makes continued association with the

¹Under Statement on Auditing Standards No. 58 (AICPA 1988), auditors no longer issue a qualified opinion for a material uncertainty, which is now reported as an unqualified opinion with an explanatory paragraph. Hence, the term "qualification" for the purpose of this study will also refer to an unqualified opinion issued for a material uncertainty.

This paper is based on my dissertation at the Ohio State University. I am indebted to my dissertation committee, Ray Stephens (Chairman), Stephen Cosslett, Douglas Schroeder, and Eric Spires for their guidance and suggestions. I have also benefited from the comments on earlier versions of this article by Celal Aksu, Steven Balsam, Ann Gabriel, Penelope Greenberg, Ralph Greenberg, Jayanthi Krishnan, Eric Press, Sridhar Ramamoorti, A. Rashad Abdel-khalik (editor), two anonymous reviewers, and seminar participants at the Ohio State University, Temple University, and the 1992 American Accounting Association Annual Meeting.

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client uneconomical or undesirable. However, the evidence indicating that opinions do not improve after switches suggests that opinion shopping is generally futile. This condition may exist because private information is obtained during the audit process, and a client usually will not be able to shop for a less conservative auditor with a prior commitment of a favorable treatment. Recent concerns about opinion shopping and its effect on auditor independence may therefore not be justified.

Key Words: *Conservatism, Auditor switching, Audit opinion, Opinion shopping.*

Data Availability: *The author has spent considerable time and effort in the collection of the data used for this study. Data will be made available upon completion of related projects.*

THE remainder of this article is organized as follows. Section I provides the motivation and develops the hypothesis. Section II outlines an empirical model to test for auditor conservatism. Sections III and IV describe the data and the results. Sensitivity analyses are presented in section V. Concluding comments appear in section VI.

I. Motivation

The relation between audit opinions and auditor switching has been examined around the themes of opinion shopping and reasons for switching. The relation between switching and the opinion issued in the preceding year has received particular attention. Chow and Rice (1982) show a significant positive coefficient for the opinion variable in estimating the decision to switch. DeAngelo (1982), Haskins and Williams (1990), Schwartz and Menon (1985) and Smith (1986) examine the issue (although only Smith [1986] makes it the main focus of analysis), but do not find a significant relation between switching and the audit opinion. Given that different methodologies are used, no consensus has emerged concerning the degree of association between switching and issuing qualified audit opinions.

A smaller number of studies concentrate specifically on opinion shopping by examining the relation between switching and the subsequent audit opinion. These results are more consistent. Chow and Rice (1982, 334) report that firms that switched after a qualified opinion were no more likely to receive a clean opinion in the year after switch than others. Using cases, Smith (1986) compared pre- and post-switch opinions, looking for conflicts between the predecessor and successor auditors. He found that, in a sample of 139 firms that changed auditors after a qualified report, only five cases suggested the possibility of opinion shopping.

In the absence of clear evidence of successful opinion shopping in the post-switch period, the continuing concerns about such shopping expressed by the Securities and Exchange Commission suggest that a further examination of the prior-year opinion and switching would be useful to policy makers, practitioners, and academicians. Previous studies that examine the opinion formulation process have not considered differences between switchers and non-switchers. This study addresses the possibility that auditors apply relatively stricter interpretations of accounting and auditing issues for certain clients, in response to which these clients switch auditors in the hopes of securing a less conservative auditor. The hypothesis tested is that, given a set of observed client financial characteristics, switchers receive more conservative treatment in the audit opinion decision than non-switchers. While relatively more conservative treatment will cause switchers to receive qualified opinions more often, it is the differential treatment rather than the issuance of the qualified opinion that triggers the switch.

II. Empirical Approach

Previous work on audit qualifications (e.g., Bell and Tabor 1991; Dopuch et al. 1987; Mutchler 1985) has used a binary dependent variable to represent qualified and clean opinions. In this article, opinions are classified into three categories of increasing seriousness: unqualified, asset realization (including litigation), and going concern. The audit opinion formulation process is modeled using ordered probit. This approach has the advantage of allowing measurement of movements between qualification levels that would be obscured in a qualified/clean dependent variable. It also allows for a measure of auditor conservatism in terms of the threshold values, after controlling for observed differences in the financial and market conditions of client firms.

Let y_i^* denote the auditor's judgment of the client's (observable) condition, specified as a function of a vector of financial and market variables X and a random error ε . Thus for client i ,

$$y_i^* = X_i\beta + \varepsilon_i. \quad (1)$$

The components of X_i are discussed in detail in the next section. The auditor applies threshold values in determining the qualification. Let y^* take values between $\underline{y}$ and $\bar{y}$. Denoting threshold values by μ_1 and μ_2 , the auditor's choice of opinions are unqualified, asset realization, and going concern when y^* falls in the ranges $(\underline{y}, \mu_1)$, (μ_1, μ_2) and $(\mu_2, \bar{y})$ respectively.

Let (μ_{1SW}, μ_{2SW}) and (μ_{1NSW}, μ_{2NSW}) denote the thresholds of switchers and non-switchers respectively, and let SWITCH be a dummy that takes the value of one if an observation is a prospective switcher, and zero otherwise. The possibility of different thresholds for the two groups is taken into account by specifying the threshold values μ_1 and μ_2 as:

$$\begin{aligned} \mu_1 &= \mu_{1NSW} + (\mu_{1SW} - \mu_{1NSW}) * \text{SWITCH}, \text{ and} \\ \mu_2 &= \mu_{2NSW} + (\mu_{2SW} - \mu_{2NSW}) * \text{SWITCH}. \end{aligned} \quad (2)$$

For the purpose of identification the first threshold for non-switchers, μ_{1NSW} , equals zero.

The model is an extended form of the standard ordered probit model.² (See Dietrich and Kaplan 1982 and McKelvey and Zavoina 1975 for detailed descriptions of the standard ordered model.) The parameters to be estimated are μ_{1SW} , μ_{2SW} , μ_{2NSW} , and β . The test of the hypothesis that switchers receive more conservative treatment than non-switchers is that $\mu_{1SW} - \mu_{1NSW} < 0$ and $\mu_{2SW} - \mu_{2NSW} < 0$.

III. Data and Variables

The primary data source is the Disclosure Inc. database. An initial sample of companies was drawn for the years 1986, 1987 and 1988.³ The process of moving from the initial collection of data to the final sample involved several steps. First, only companies with data on the CRSP tapes (New York, American and NASDAQ daily files) were retained. Market variables were constructed using data from CRSP, but companies with price data for less than 70 trading days were deleted. Second, financial service companies (SIC Codes 6000-6999) were excluded because

²The log likelihood function L^* for a sample of size N is given by:

$$\begin{aligned} L^* = \sum_{i=1}^N \bigg\{ & Z_{i1} \ln[\Phi(\mu_{1SW} * \text{SWITCH}_i - X_i\beta)] + Z_{i2} \ln[\Phi(\mu_{2NSW} + (\mu_{2SW} - \mu_{2NSW}) * \text{SWITCH}_i - X_i\beta) \\ & - \Phi(\mu_{1SW} * \text{SWITCH}_i - X_i\beta)] + Z_{i3} \ln[1 - \Phi(\mu_{2NSW} + (\mu_{2SW} - \mu_{2NSW}) * \text{SWITCH}_i - X_i\beta)] \bigg\} \end{aligned}$$

where $Z_{ij} = 1$, if $\text{OPINION}_i = j$, zero otherwise, and $j=1,2,3$.

³The initial list of companies was drawn from March 1988 to March 1990 data discs.

variables used in studies such as this one may be inappropriate for these firms (Dopuch et al. 1987, 434). Third, companies that filed for bankruptcy in the year before switch were dropped. Finally, some observations were deleted because of incomplete data. The main analysis is based on 2,989 observations for 1986 and 1987, while the 1988 data, comprising 808 companies, were retained as a time series holdout sample to test the predictive ability of the model.

The dependent variable, *OPINION*, represents the auditor's opinion in the year before the switch. It takes the value 1 for unqualified opinions (U), 2 for asset realization (including litigation) opinions (AR), and 3 for going concern opinions (GC).⁴ Consistency exceptions for voluntary and mandatory accounting changes are included in the unqualified category. Litigation qualifications include tax uncertainties. The asset realization category includes future financing opinions in which the possible violation of the going concern assumption is not stated, and multiple qualifications involving litigation and asset realization. Multiple qualifications arising in conjunction with the going concern opinion are included in the going concern category.

The switching variable, *SWITCH*, denoting the *prospective* switching status of the firm, is coded one if the firm changed auditors in the year *following* the issuance of the opinion, zero otherwise. Prospective switchers were identified by comparing the current year auditor with that in the next year.⁵ The switching rate in the sample is 6.6 percent.

Since this study focuses on the different treatment of switchers and non-switchers, the choice of independent variables is based on previous work, especially that of Dopuch et al. (1987). The variables consist of a set of financial and market variables, and controls representing auditor type, time listed, and industry affiliation. Ratios of receivables and inventory to assets are used to capture high risk accounts. Firm size (measured by the logarithm of assets) and a dummy for operating losses are included as proxies for possible financial distress. The liabilities/assets ratio measures leverage. Beta and residual standard deviation of returns from the standard market model are used as measures of systematic and firm-specific risks, respectively. The firm's performance relative to the market is measured by its returns minus market return.

Descriptive statistics for the full sample and for qualification and switching groups are presented in table 1. The frequency of switching increases significantly as one moves from the unqualified opinion to the going concern opinion. Among the explanatory variables, the incidence of loss and the residual standard deviation of returns increase, on average, with the seriousness of the qualification. The liabilities/assets ratio and firm size do not differ across the unqualified and asset realization qualification groups. However, firms in the going concern category are significantly smaller and have higher liabilities/assets ratio than those in the asset realization category. The receivables/assets and inventory/assets ratios are both lower, on average, for the asset realization category than for the unqualified group. While the latter ratio is higher for the going concern group than the asset realization group, the former is similar over the two qualification groups. One surprising finding is that clients' systematic risk, as measured by beta, decreases as one moves from the unqualified opinion to the asset realization opinion. However, the going concern clients have a higher mean beta than that of the asset realization category. Returns minus market return is not significantly different across the unqualified and asset realization groups, but is distinctly lower for the going concern category. Firms with going

⁴The audit opinions were verified through comparisons with other sources, such as 10-K filings, annual reports, and COMPUSTAT. Companies for which audit opinions could not be verified from a second source were dropped.

⁵The switching status of each company was verified by examining other sources such as COMPUSTAT, *Who Audits America*, 10-K and 8-K filings, and annual reports.

Table 1
Descriptive Statistics for Full Sample, Opinion Categories, Switchers, and Non-Switchers

Variable	Full Sample	Opinion Categories				Switching Status			
		Mean		t-statistic ^a		Mean		t-statistic ^a	
		(standard deviation)		(p-value)		(standard deviation)		(p-value)	
		U	AR	GC	AR vs. U	GC vs. AR	SW	NSW	SW vs. NSW
SWITCH	0.066 (0.248)	0.052 (0.222)	0.116 (0.321)	0.196 (0.398)	3.539 (0.000)	2.113 (0.035)			
OPINION	1.197 (0.546)						1.517 (0.818)	1.174 (0.514)	8.125 (0.000)
L/A	0.532 (0.538)	0.503 (0.469)	0.516 (0.342)	0.912 (1.069)	0.362 (0.717)	4.665 (0.000)	0.562 (0.347)	0.530 (0.549)	0.809 (0.419)
R/A	0.173 (0.139)	0.181 (0.140)	0.112 (0.113)	0.130 (0.131)	-6.335 (0.000)	1.470 (0.142)	0.176 (0.149)	0.173 (0.138)	0.350 (0.727)
I/A	0.153 (0.158)	0.158 (0.155)	0.094 (0.141)	0.146 (0.187)	-5.292 (0.000)	3.051 (0.002)	0.152 (0.168)	0.153 (0.157)	-0.143 (0.886)
LOSS	0.365 (0.481)	0.310 (0.463)	0.477 (0.501)	0.952 (0.214)	4.532 (0.000)	10.481 (0.000)	0.624 (0.486)	0.346 (0.476)	7.834 (0.000)
LASSET	4.010 (2.384)	4.186 (2.266)	4.082 (3.001)	1.762 (2.104)	-0.571 (0.568)	-8.844 (0.000)	2.507 (2.068)	4.116 (2.370)	-9.286 (0.000)
BETA	1.098 (0.776)	1.109 (0.752)	0.934 (0.807)	1.094 (1.002)	-2.945 (0.003)	1.690 (0.092)	0.972 (0.905)	1.107 (0.765)	-2.354 (0.019)
SDRET	0.035 (0.019)	0.033 (0.018)	0.038 (0.025)	0.052 (0.021)	3.126 (0.002)	5.843 (0.000)	0.043 (0.021)	0.034 (0.019)	6.271 (0.000)
RET-MRET	-0.001 (0.235)	0.007 (0.223)	0.005 (0.255)	-0.107 (0.328)	-0.100 (0.921)	-3.654 (0.000)	-0.020 (0.311)	0.000 (0.229)	-1.139 (0.254)
TIME	8.759 (8.659)	8.899 (8.710)	10.722 (9.508)	5.406 (6.115)	2.644 (0.008)	-6.595 (0.000)	5.447 (6.430)	8.993 (8.749)	-5.583 (0.000)
BIG6	0.837 (0.369)	0.854 (0.353)	0.791 (0.408)	0.665 (0.473)	-2.248 (0.025)	-2.719 (0.006)	0.670 (0.471)	0.849 (0.358)	-6.567 (0.000)
N	2,989	2,608	172	209			197	2,792	

(Continued)

Table 1 (Continued)
Descriptive Statistics for Full Sample, Opinion Categories, Switchers, and Non-Switchers

^a Tests the hypothesis that the means for the specified groups are different. For dummy variables, Z-statistics (to test for difference in proportions) are reported.

SWITCH	=	1 if client changes auditors in the period following the current one (SW), zero otherwise (NSW);
OPINION	=	1 if unqualified (U), 2 if asset realization or litigation (AR), and 3 if going concern (GC);
L/A	=	ratio of total liabilities to total assets;
R/A	=	ratio of receivables to total assets;
I/A	=	ratio of inventory to total assets;
LOSS	=	1 if income is negative for the current year, zero otherwise;
LASSET	=	natural logarithm of book value of total assets (\$ millions) at the fiscal year end deflated by implicit price deflator for GNP;
BETA	=	beta, the slope coefficient of market model regression;
SDRET	=	residual standard deviation of returns from market model regression;
RET-MRET	=	common stock returns (including dividends) minus equally weighted market return (%);
TIME	=	years listed on the NYSE, AMEX, or NASDAQ; and
BIG6	=	1 if auditor is a Big Six auditor, zero otherwise. (Pre-merger firms are included as part of post-merger firms.)
BETA, SDRET, and RET-MRET	=	were calculated for a period of 260 trading days prior to year end. Observations were eliminated if there were fewer than 70 trading days.

Table 2
Extended Ordered Probit Estimates

<i>Threshold/ Variable</i>	<i>Expected Sign</i>	<i>Parameter Estimate</i>	<i>t-statistic</i>
<i>Threshold:</i>			
μ_{1NSW}		0.000	
$\mu_{1SW} - \mu_{1NSW}$	-	-0.498 ^a	-4.604
μ_{2NSW}	+	0.460 ^a	10.750
$\mu_{2SW} - \mu_{2NSW}$	-	-0.559 ^a	-4.234
<i>Variable:</i>			
CONSTANT		-1.417	-8.932
L/A	+	0.264 ^a	12.030
R/A	+	-1.373 ^a	-5.108
I/A	+	0.176 ^a	0.642
LOSS	+	0.738 ^a	7.637
LASSET	-	-0.147 ^a	-6.501
BETA	+	0.017 ^a	0.417
SDRET	+	8.744 ^a	4.523
RET-MRET	-	-0.533 ^a	-4.271
TIME	-	0.030 ^a	5.099
BIG6		-0.103	-1.205
Y87 ^b		-0.154	-2.190
Industry Dummies		^c	
R ²		0.371	
Chi-squared		577.780	
p-value		0.000	
N		2,989	

^a One-tailed test (two-tailed otherwise).

^b 1 if the observation belongs to year 1987.

^c One digit industry dummy variables were used. Agriculture, forestry, and fishing and mining were combined because there were few observations in each group. The following industry variables were significant: Manufacturing (-0.183, t = -1.839), Transportation (0.636, t = 5.039), and Retail (-0.915, t = -3.677).

OPINION (Dependent Variable) = 1 if unqualified, 2 if asset realization or litigation, and 3 if going concern. μ_{1NSW} , μ_{2NSW} , μ_{1SW} , and μ_{2SW} are the first and second thresholds for non-switchers and switchers, respectively. The first threshold for non-switchers is normalized to zero. Other variables are defined in table 1.

concern opinions have the lowest mean for time listed on an exchange. However, time listed is higher on average for the asset realization category than for the unqualified group.

The incidence of qualified opinions is significantly higher for switchers as compared to non-switchers. Relative to non-switchers, switching clients tend to be smaller, and incur losses more often. The residual standard deviation of returns is higher for switchers, while beta and time listed are significantly lower. The three financial ratios and returns minus market return are not significantly different for the two groups.

IV. Empirical Results

Extended Ordered Probit Model Estimates

Table 2 presents the estimates of the extended ordered probit.⁶ The model chi-squared statistic has a p-value less than 0.001. The R^2 (as defined in McKelvey and Zavoina 1975) for the model is 0.371. A Hausman specification test (Hausman 1978) was also conducted with the binary probit model defined as the alternative specification. The results support the null hypothesis of no misspecification ($p = 0.247$).

Among the explanatory variables, the liabilities/assets ratio, losses, residual standard deviation of returns, returns minus market return, and firm size have significant coefficients in the expected direction. The coefficients of the receivables/assets ratio and time listed have unexpected signs.⁷ Beta and the inventory/assets ratio have statistically insignificant coefficients.⁸

The first threshold for non-switchers is normalized to zero. The second threshold for non-switchers is significantly positive, suggesting the appropriateness of the ordered probit model. The differences between the first thresholds of switchers and non-switchers, $\mu_{1SW} - \mu_{1NSW}$, and that between the second thresholds, $\mu_{2SW} - \mu_{2NSW}$, are both negative and statistically significant at below the one percent level.⁹

The finding that switchers have lower thresholds than non-switchers suggests that switching may be motivated by auditor conservatism, rather than by the issuance of a qualified opinion *per se*. Consider an alternative naive model in which clients are expected to switch in response to a qualified opinion, regardless of treatment. In such a model, a client would switch auditors even when a qualified opinion is deserved. By contrast, the model presented here suggests that clients would switch auditors only when they perceive the qualification issued to be “undeserved”; i.e., the result of a conservative treatment. The client’s deserved opinion can be approximated by using a simple ordered probit model with uniform thresholds for all clients. According to the naive model, the switching rate for clients that deserve an asset realization or going concern opinion will be higher than that for clients that deserve an unqualified opinion. However, the conservatism

⁶Pooled data for 1986 and 1987 is used in this study because the number of observations in each qualification category is small in each year, particularly when categorized by switching status. A likelihood ratio test did not reject the null hypothesis of no difference in slope coefficients across years ($p = 0.431$).

⁷Dopuch et al. (1987) also report finding an opposite sign on their change in receivables/total assets ratio variable.

⁸The correlation matrix (not reported) showed that the correlations between residual standard deviation of returns and (log) assets (-0.535) and between time listed and (log) assets (0.621) may result in multicollinearity. Reestimation of the model after dropping residual standard deviation of returns and time listed (separately), however, showed no change in the qualitative results. None of the other correlations exceeded 0.45.

⁹To check the robustness of the results, the model was reestimated on 100 randomly generated samples of 2,989 observations, each drawn *with replacement* from the estimation sample. The differences in both thresholds for switchers and non-switchers were negative and statistically significant in each of these 100 samples.

Table 3
Impact of Conservatism on Switching Rates

<i>Predicted Opinion from Ordered Probit Model^a</i>	<i>Predicted Opinion from Extended Ordered Probit Model^b</i>	<i>Switching Rate (%)</i>
Unqualified		<u>6.22</u>
	Unqualified	5.75
	Asset Realization	11.36
	Going Concern	22.22
Asset Realization		<u>20.55</u>
	Asset Realization	0.00
	Going Concern	20.55
Going Concern		<u>8.33</u>

^aDerived from a simple ordered probit (estimates not reported) using average thresholds for all clients.

^bDerived from the extended ordered probit reported in table 2, using conservative thresholds for all clients.

model has the following implications: (1) among firms that deserve unqualified opinions, the switching rate will be higher for those that had actually received asset realization qualifications or going concern opinions than for those that received unqualified opinions; (2) among clients that deserve the asset realization qualification, the switching rate will be higher for clients that had actually received the going concern opinion than for those that received the asset realization qualification.¹⁰ No predictions can be made for the going concern opinion, since the application of conservative standards cannot yield a more serious outcome.

Predicted opinions from the ordered probit (in which all clients face the same thresholds) and the extended ordered probit (using the conservative thresholds) were cross-classified and switching rates were computed for the subgroups mentioned above. The results are shown in table 3. Looking first at the naive model, the switching rates for firms that deserve unqualified, asset realization, and going concern opinions are 6.22 percent, 20.55 percent, and 8.33 percent respectively. These rates support the hypothesis of the naive model: clients deserving qualified opinions switch more often. However, the application of conservative thresholds reveals a different picture. Among clients that deserve unqualified opinions but receive qualified opinions due to apparent conservative treatment, the switching rate is significantly higher (11.36 percent for asset realization and 22.22 percent for going concern) than for clients that both deserve and receive unqualified opinions (5.75 percent). Similarly, while firms that deserve an asset realization qualification have a switching rate of 20.55 percent, all of these clients receive going concern opinions because of the apparent conservative application of standards. The pattern of

¹⁰ The model also predicts that clients who receive unqualified opinions by the application of conservative standards have a higher probability of switching than those who receive unqualified opinions by the application of average standards. However, such behavior cannot be tested, since the actual thresholds are not observed.

switching is therefore consistent with the notion that clients switch in situations where such opinions are the result of conservatism not simply because of receiving qualified opinions.

Model Validity

An assessment of the predictive ability of the model is presented in table 4. Because the model generates six types of misclassification errors, a simplifying assumption was made. All type I misclassifications (going concern opinions as asset realization qualifications or unqualified opinions, and asset realization qualifications as unqualified opinions) were assumed to have equal costs. Similarly, all type II misclassification errors were assigned equal costs. Expected misclassification costs were generated for the model, using the following assumptions about the relative costs of type I and type II errors: 1:1, 5:1, 10:1, 20:1, 30:1, and 40:1.¹¹ For each cost configuration, two cut-off probability scores were selected to minimize the expected cost of misclassification. The cut-offs specify the minimum probabilities for the sum of the estimated probabilities for going concern and asset realization qualifications, and for the going concern qualification.

Ten randomly generated samples, with replacement from the estimation sample, were used to generate cut-off probabilities that minimize expected misclassification costs. Correspondingly, ten samples were generated randomly with replacement from the holdout sample. Cut-off probabilities from each random sample were then used to tabulate misclassifications in a random holdout sample. Cut-off probabilities and the magnitude of type I and type II errors for the estimation sample are shown in table 4, panel A.¹² The resulting misclassifications, averaged over the ten holdout samples, are shown in panel B. The expected costs of misclassification are compared to errors generated by a naive strategy that classifies all observations as unqualified. The results from the estimation sample indicate that the relative efficiency of the model compared to the naive strategy is low (0.924) at equal costs but increases rapidly as type I errors become more expensive. The pattern for the holdout sample is similar to that of the estimation sample in all respects, bearing out the reasonable in-sample performance of the model.

V. Sensitivity Analyses

Other Reasons for Switching

The sample of switchers in the above analysis includes all kinds of switchers. A more refined analysis would require exclusion of switchers that move for reasons unrelated to auditor conservatism. Other reasons identified in the literature include change in management, need for additional services, lower fees, search for prestigious auditor, anticipation of bankruptcy, audit firm mergers, and reduction of agency costs.¹³ Previous work has also noted the inherent

¹¹ The expected misclassification costs are given by:

$$EC = [(a)P_I^{AR} + (b)P_I^{GC}]C_I + [(a)P_{II}^{AR} + (1-a-b)P_{II}^U]C_{II},$$

where a = prior probability of qualification AR; b = prior probability of qualification GC; $1-a-b$ = prior probability of an unqualified opinion U; P_I^{AR} = probability of predicting AR as U; P_I^{GC} = probability of predicting GC as AR or U; P_{II}^{AR} = probability of predicting AR as GC; P_{II}^U = probability of predicting U as AR or GC; C_I = cost of predicting GC as AR or U, or AR as U; and C_{II} = cost of predicting U as AR or GC, or AR as GC.

¹² Because of the assumption of equal weight for errors within the type I and type II groups, the minimization procedure effectively chooses the cut-offs based on the *weighted* sums of type I and type II errors. Consequently, table 4 reports the weighted probabilities for type I and type II errors.

¹³ Studies that cover these reasons are Bedingfield and Loeb (1974), Burton and Roberts (1967), Carpenter and Strawser (1971), Chow and Rice (1982), DeFond (1992), Eichenseher and Shields (1983), Francis and Wilson (1988),

Table 4
Model Performance: Probability of Errors and Misclassification Costs

Panel A. Estimation Sample:^a

Relative Costs of Type I & Type II Errors	Cut-off Probability for AR & GC Qualifi- cations	Cut-off Probability for GC Qualifica- tion	Probability of Classification Errors		Cost of Model Errors Relative to Cost of Errors from a Naive Strategy ^e
			Type I ^c	Type II ^d	
1:1	0.480	0.311	0.101	0.017	0.924
5:1	0.218	0.075	0.051	0.158	0.649
10:1	0.066	0.025	0.011	0.423	0.415
20:1	0.052	0.022	0.008	0.461	0.244
30:1	0.043	0.010	0.007	0.493	0.181
40:1	0.022	0.013	0.002	0.646	0.142

Panel B. Holdout Sample, Bootstrap Analysis:^b

Relative Costs of Type I & Type II Errors	Probability of Classification Errors		Cost of Model Errors Relative to Cost of Errors from a Naive Strategy ^e
	Type I ^c	Type II ^d	
1:1	0.079	0.036	0.987
5:1	0.030	0.196	0.600
10:1	0.011	0.417	0.452
20:1	0.008	0.500	0.286
30:1	0.007	0.568	0.220
40:1	0.005	0.616	0.177

^aThe estimation sample consists of 2,608 unqualified (U), 172 asset realization or litigation (AR), and 209 going concern (GC) observations.

^bThe reported results are the average across 10 randomly generated holdout (with replacement) samples which consist of 808 observations.

^cWeighted sum of all type I errors; see footnote 12.

^dWeighted sum of all type II errors; see footnote 12.

^eThe naive strategy classifies all firms into the unqualified category.

difficulties in determining precise reasons for auditor switches (e.g., McConnell 1984). In some cases, reasons such as cost saving may mask situations of disagreements (Power 1984). In others, no reason is revealed. For the sample of switchers in this study, self-reported reasons could be found (in Public Accounting Reports) for only 61 firms. Three reasons dominated: dissatisfaction with service (33 percent), dissatisfaction over fees (30 percent), and disagreements over accounting issues (18 percent). Other reasons given were management change, change by parent company, change of engagement partner, and resignation.

Two kinds of sensitivity analyses are conducted. First, companies that reported changing auditors because of high fees were assumed to be switching for reasons unrelated to auditor conservatism and were deleted from the sample. Second, an independent attempt was made to

identify some kinds of “other” switchers. Three other reasons for switching, identified in previous work, were used: initial public offerings (IPOs), rapid growth, and search for “credible” auditors (Carpenter and Strawser 1971; Dopuch and Simunic 1982; Johnson and Lys 1990; Menon and Williams 1991; Simunic and Stein 1987). IPO companies are those that either have issued such stock in the recent past or intend to issue such stock in the near future. Rapid growth companies are those with asset growth of over 75 percent during the year of switch. Clients that switch from non-Big Eight (now Big Six) to Big Eight auditors are defined as movers in search of credibility.

The effects on the thresholds of excluding these switchers from the sample are shown in table 5, which also reproduces for convenience the full sample results from table 2. Coefficient estimates for explanatory variables are not reported in this table (or in table 6) because these estimates are similar to those in table 2.

If other switchers move for reasons unrelated to auditor conservatism, there is no reason to expect thresholds to be different for such switchers and non-switchers. Inclusion of these switchers would yield downward-biased estimates of the absolute difference in thresholds of switchers and non-switchers. The results in columns 2 through 5 of table 5 indicate that, in all cases, thresholds for switchers are significantly lower than those for non-switchers. The point estimate of the difference in thresholds changes slightly across the columns, but there is no general trend towards weakening or strengthening the full sample results. An interesting exception is in column 2, where the exclusion of clients (self-reportedly) moving because of high fees yields considerably lower threshold differences between switchers and non-switchers. This result suggests that these switchers also receive conservative treatment, confirming Power’s (1984) suggestion that such switchers may not reveal their true reasons for switching. One problem with these tests is that they may be limited in their ability to detect differences because the number of observations dropped in each case is small. However, the qualitative results remain unchanged in column 6 when all other switchers (comprising 40 percent of the switchers in the full sample) are deleted.

Litigation Qualifications

Litigation qualifications are included in the asset realization category. Signs of financial distress may be less obvious in situations involving litigation qualifications since the liability for the lawsuit is not recorded on the financial statements (Dopuch et al. 1987, 435). However, threshold estimates for switchers continue to be significantly lower than those for non-switchers (table 5, column 7) when litigation qualifications are excluded.

Further Sensitivity Analysis

An alternative explanation for the differential threshold estimates is that it is the effect of a client characteristic that is likely to be correlated with the propensity to switch, as well as the auditor’s propensity to be conservative. One such characteristic is client size. The earlier findings of a negative relation between client size and auditor switching rates (Coe and Palmon 1979; Haskins and Williams 1990) are confirmed by the current data. Using three definitions of “large” firms (those with assets greater than \$100 million, \$150 million, and \$200 million), the switching rates for large firms are 2.74 percent, 2.47 percent, and 2.52 percent, while those for small firms are 8.82 percent, 8.45 percent, and 8.16 percent respectively.¹⁴ The chi-square test (not reported) for the association between client size and auditor switching rejects the null hypothesis of independence of the two variables in all three cases ($p < 0.001$).

¹⁴Previous work (e.g., Palmrose 1986, 109) has used a cut-off of \$150 million in assets to define large clients. Three definitions of large firms are used here because the distribution of assets is highly skewed: the first quartile, median, and third quartile are \$9.4, \$43.2, and \$262.4 million, respectively.

Table 5
Effect of Exclusion of Other Switchers and Litigation Qualifications on Threshold Estimates
 (t-statistics in parentheses)

	Excludes "Other" Switchers				Excludes all "Other" Switchers (6)	Excludes Litigation Qualifications (7)
	Full Sample (1)	High Fees (2)	IPO Companies (3)	Rapid Growth Companies (4)	Non-Big Six to Big Six (5)	
μ_{1NSW}	0.000	0.000	0.000	0.000	0.000	0.000
$\mu_{1SW}-\mu_{1NSW}$	-0.498 (-4.604)	-0.409 (-3.642)	-0.516 (-4.695)	-0.483 (-4.363)	-0.483 (-4.045)	-0.421 (-3.434)
μ_{2NSW}	0.460 (10.750)	0.459 (10.749)	0.463 (10.764)	0.461 (10.744)	0.461 (10.709)	0.332 (8.575)
$\mu_{2SW}-\mu_{2NSW}$	-0.559 (-4.234)	-0.419 (-2.894)	-0.565 (-4.189)	-0.543 (-4.051)	-0.592 (-4.270)	-0.570 (-4.304)
R ²	0.371	0.366	0.374	0.370	0.378	0.424
Chi-squared	577.780	544.520	581.240	569.000	572.340	580.110
p-value	0.000	0.000	0.000	0.000	0.000	0.000
N	2,989	2,971	2,972	2,976	2,955	2,922

Note: All tests in this table are one-tailed. The variables included in this equation are the same as in table 2.

OPINION (Dependent Variable) = 1 if unqualified, 2 if asset realization or litigation, and 3 if going concern. μ_{1NSW} , μ_{1SW} , μ_{2NSW} , and μ_{2SW} are the first and second thresholds for non-switchers and switchers, respectively. The first threshold for non-switchers is normalized to zero.

Table 6
Client Size and Switching: Threshold Estimates

	Definition of "Large" Client: Assets greater than					
	\$100 million		\$150 million		\$200 million	
	Parameter Estimate	t-statistic	Parameter Estimate	t-statistic	Parameter Estimate	t-statistic
$\mu_{1s,NSW}$	0.000		0.000		0.000	
$\mu_{1e,NSW}$	0.303	2.435	0.282	2.131	0.194	1.443
$\mu_{1s,SW} - \mu_{1s,NSW}$	-0.484	-4.245	-0.505	-4.494	-0.521	-4.653
$\mu_{1e,SW} - \mu_{1e,NSW}$	-0.953	-3.145	-0.931	-2.819	-0.865	-2.548
$\mu_{2s,NSW}$	0.357	9.289	0.357	9.462	0.357	9.548
$\mu_{2e,NSW}$	1.135	7.761	1.201	6.967	1.176	6.295
$\mu_{2s,SW} - \mu_{2s,NSW}$	-0.493	-3.659	-0.524	-3.971	-0.544	-4.139
$\mu_{2e,SW} - \mu_{2e,NSW}$	-1.103	-2.947	-0.970	-1.949	-0.795	-1.380
R^2	0.330		0.334		0.336	
Chi-squared	573.900		576.800		576.120	
p-value	0.000		0.000		0.000	
N (Large Switchers)	30		23		21	
N (Small Switchers)	167		174		176	
N (Large Non-switchers)	1,065		907		811	
N (Small Non-switchers)	1,727		1,885		1,981	

Note: All tests in this table are one-tailed. The independent variables included in this equation are the same as in table 2, excluding log (assets).
OPINION = 1 if unqualified, 2 if asset realization or litigation, and 3 if going concern (Dependent Variable);
 $\mu_{1s,NSW}$ = first threshold for small non-switchers (normalized to zero);
 $\mu_{2s,NSW}$ = second threshold for small non-switchers;
 $\mu_{1e,NSW}$ = first threshold for large non-switchers;
 $\mu_{2e,NSW}$ = second threshold for large non-switchers;
 $\mu_{1s,SW}$ = first threshold for small switchers;
 $\mu_{2s,SW}$ = second threshold for small switchers;
 $\mu_{1e,SW}$ = first threshold for large switchers; and
 $\mu_{2e,SW}$ = second threshold for large switchers.

Client size can be expected to be negatively correlated with auditor conservatism because of the lower risk associated with such clients (Johnson and Lys 1990), or because larger firms may enjoy greater bargaining power since they pay higher fees (McKeown et al. 1991). Table 6 presents an extended model with different thresholds estimated for large and small switchers and for large and small non-switchers.¹⁵ Lower thresholds for switchers as compared to non-switchers persist within each size group at both threshold levels and for all three definitions of "large" firm size. However, the switcher-nonswitcher threshold differences for large clients weaken as the cut-off for large clients goes from \$100 million to \$200 million, particularly at the going concern qualification level. One explanation for this result is that as client size increases, auditor switching is more expensive from the client's point of view because of possible negative stock reactions and the costs of searching for a new auditor. The switcher-nonswitcher difference may then weaken as clients' switching response to auditor conservatism weakens. Another explanation is that auditors are less willing to be conservative toward big clients for fear of losing them. Despite this exception, client size alone cannot explain the difference in the thresholds of switchers and non-switchers.

VI. Concluding Comments

Policy makers have in recent years expressed concern over opinion shopping. This study suggests that switching is triggered by conservative treatment rather than by the issuance of qualified opinions. Also, switching rates seem to be higher when qualified opinions are based on a conservative application of standards. Moreover, the basic result is invariant to several sensitivity tests: removal of switchers who move for reasons unrelated to conservatism, exclusion of litigation qualifications, and control for a potentially confounding factor, client size. These results are indicative of different auditor behavior but the specifics and motivation for applying audit standards more conservatively remain to be explored.

The conservative treatment of switchers as compared to non-switchers suggests that clients *may* attempt to shop for better opinions. However, prior studies have not found evidence of success at such shopping. Because client-specific private information (e.g., deteriorating controls, knowledge of the loss of key contracts) is known only after an auditor is hired, the client cannot accurately predict a new auditor's attitude prior to the engagement. Thus, the oft-expressed concern over opinion shopping and lack of auditor independence may not be justified.

¹⁵For the estimation of these equations, the variable log (assets) is not included in the X vector, since the (dummy) size variables are now specified in the thresholds.

References

- American Institute of Certified Public Accountants (AICPA). 1988. *Statement on Auditing Standards No. 58: Reports on Audited Financial Statements*. New York: AICPA.
- Bedingfield, J. B., and S. E. Loeb. 1974. Auditor changes—An examination. *Journal of Accountancy* 137 (March): 66-69.
- Bell, T. B., and R. H. Tabor. 1991. Empirical analysis of audit uncertainty qualifications. *Journal of Accounting Research* 29 (Autumn): 350-70.
- Burton, J. C., and W. Roberts. 1967. A study of auditor changes. *Journal of Accountancy* 123 (April): 31-36.
- Carpenter, C. G., and R. H. Strawser. 1971. Displacement of auditors when clients go public. *Journal of Accountancy* 131 (June): 55-58.
- Chow, C. W., and S. J. Rice. 1982. Qualified audit opinions and auditor switching. *The Accounting Review* 57 (April): 326-35.

- Coe, T. L., and D. Palmon. 1979. Some evidence of the magnitude of auditor turnover. Working paper, New York University.
- DeAngelo, L. E. 1982. Mandated successful efforts and auditor choice. *Journal of Accounting and Economics* 4 (December): 171-203.
- DeFond, M. L. 1992. The association between changes in client firm agency costs and auditor switching. *Auditing: A Journal of Practice & Theory* 11 (Spring): 16-31.
- Dietrich, J. R., and R. S. Kaplan. 1982. Empirical analysis of the commercial loan classification decision. *The Accounting Review* 57 (January): 18-38.
- Dopuch, N., and D. Simunic. 1982. Competition in auditing: An assessment. *Fourth Symposium on Auditing Research*. 401-50. Department of Accountancy, Urbana: University of Illinois.
- _____, R. W. Holthausen, and R. W. Leftwich. 1987. Predicting audit qualifications with financial and market variables. *The Accounting Review* 62 (July): 431-54.
- Eichenseher, J. W., and D. Shields. 1983. The correlates of CPA-firm change for publicly-held corporations. *Auditing: A Journal of Practice & Theory* 2 (Spring): 23-37.
- Francis, J. R., and E. R. Wilson. 1988. Auditor changes: A joint test of theories relating to agency costs and auditor differentiation. *The Accounting Review* 63 (October): 663-82.
- Haskins, M. E., and D. D. Williams. 1990. A contingent model of intra-Big Eight auditor changes. *Auditing: A Journal of Practice & Theory* 9 (Fall): 55-74.
- Hausman, J. A. 1978. Specification tests in econometrics. *Econometrica* 46 (November): 1251-71.
- Healy, P., and T. Lys. 1986. Auditor changes following Big Eight mergers with non-Big Eight audit firms. *Journal of Accounting and Public Policy* 5 (Winter): 251-65.
- Johnson, W. B., and T. Lys. 1990. The market for audit services: Evidence from voluntary auditor changes. *Journal of Accounting and Economics* 12 (January): 281-308.
- Knapp, M. C., and F. Elikai. 1988. Auditor changes: A note on the policy implications of recent analytical and empirical research. *Journal of Accounting, Auditing and Finance*, n.s. 3 (Winter): 78-86.
- McConnell, D. K. Jr., 1984. Auditor changes and related disagreements. *Auditing: A Journal of Practice & Theory* 3 (Spring): 44-56.
- McKelvey, R. D., and W. Zavoina. 1975. A statistical model for the analysis of ordinal level dependent variables. *Journal of Mathematical Sociology* 4 (Summer): 103-20.
- McKeown, J. C., J. F. Mutchler, and W. Hopwood. 1991. Towards an explanation of auditor failure to modify the audit opinions of bankrupt companies. *Auditing: A Journal of Practice & Theory* 10 (Supplement): 1-13.
- Menon, K., and D. D. Williams. 1991. Auditor credibility and initial public offerings. *The Accounting Review* 66 (April): 313-32.
- Mutchler, J. F. 1985. A multivariate analysis of the auditor's going-concern opinion decision. *Journal of Accounting Research* 23 (Autumn): 668-82.
- Palmlrose, Z. 1986. Audit fees and auditor size: Further evidence. *Journal of Accounting Research* 24 (Spring): 97-110.
- Power, C. 1984. Canned accountants. *Forbes* 133 (January 16): 123.
- Schwartz, K. B., and K. Menon. 1985. Auditor switches by failing firms. *The Accounting Review* 60 (April): 248-61.
- Securities and Exchange Commission. 1985. *Release No. 33-6594: Request for Comments on "Opinion Shopping."* Chicago: Commerce Clearing House.
- _____. 1989. *Financial Reporting Release No. 34: Acceleration of the Timing for Filing Forms 8-K Relating to Changes in Accountants and Resignations of Directors; Amendments to Regulation S-K Regarding Changes in Accountants.* Chicago: Commerce Clearing House.
- Simunic, D. A., and M. T. Stein. 1987. *Product Differentiation in Auditing: Auditor Choice in the Market for Unseasoned New Issues.* Vancouver, BC: The Canadian Certified General Accountants' Research Foundation.
- Smith, D. B. 1986. Auditor "subject to" opinions, disclaimers, and auditor changes. *Auditing: A Journal of Practice & Theory* 6 (Fall): 95-108.

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On the Design of Unconditional Monitoring Systems in Agencies

*Stanley Baiman
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SYNOPSIS AND INTRODUCTION: In the usual agency analysis of moral hazard, the principal is endowed with a production process and must hire an agent to manage it. Output depends on the agent's effort, the production process supplied by the principal, and some random state realization. A common assumption is that the output of the production process is costlessly observable and sufficiently informative about the agent's effort to warrant using it for contracting. However, this assumption may not be descriptive of a large number of settings. In fact, it is hard to conceive of many production settings in which the gathering and reporting of any information is totally free and independent of costly design decisions. For example, if the agent produces some product, it is not costless to monitor the number or the quality of the units produced; someone must be paid or a machine must be purchased to do so. In addition, some opportunity cost may have to be incurred to rearrange the production process to facilitate the assessment of the agent's work.

In this article, we consider the implications of relaxing the assumption that output is costlessly observable and contractible, by analyzing the optimal design of a costly unconditional monitoring system. We characterize the monitoring system in terms of the Type I error associated with the obedient action and the Type II errors associated with the disobedient actions. We find that it is always optimal to design the monitoring system such that the Type I error is smaller than the Type II error for any disobedient action. Further, we find that as the costliness of the monitoring system increases, the Type I error increases monotonically, while the Type II error initially decreases and then increases.

Key Words: *Principal-agent model, Value of monitoring.*

Data Availability: *More detailed versions of all of the proofs in the appendix are available from the authors.*

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THE remainder of the article is organized as follows. In the next section, we relate our work to the relevant literature. In section II, we present and explain the basic model used in the analysis. Section III contains an analysis of the optimal design of the costly unconditional monitoring system. We summarize the analysis and discuss future work in section IV.

I. Literature Review

Most studies that have dealt with the choice of monitoring systems examine the effect of acquiring better *costless* information. Of those that examine the effect of acquiring better *costly* information, most model a situation in which the principal has a primary costless system that unconditionally reveals the production output (e.g., the cash flows to the firm). Having observed the costless primary signal, the principal's problem is when to acquire a costly additional signal from another monitoring system with fixed statistical characteristics.¹ In contrast, we study the design of costly *unconditional* post-decision monitoring systems in situations without an alternative, costlessly available signal.²

Our analysis is most closely related to the work by Aron and Olivella (1991). The major differences are that we consider a richer type of monitoring system and assume that the principal commits to a given level of monitoring quality. Such commitment is not allowed by Aron and Olivella.

II. The Model

We model a moral hazard problem in a single-period setting. A risk-neutral principal hires a risk- and work-averse agent to take some action $a \in \{a_i, i = 1, \dots, n\}$, which the principal cannot directly observe. The agent's action generates an uncertain output. We assume that the output (e.g., cash flow) cannot be used as a contracting variable, for two reasons. First, as discussed earlier, we want to relax the assumption of costlessly available, contractible information such as output. Second, if the output were a contracting variable, we would not be able to separate the production and motivational effects of changing the relationship between the probability distribution over the output/signal and each action choice. By allowing contracting only on a separate variable, we are able to study the motivational effect of changing the monitoring system, while holding fixed the production effect.

The only contractible signal is y_k , $k=1,2$. We use p_i to denote the probability that action i will generate monitoring signal y_1 , and $1 - p_i$ is the probability that action i will generate monitoring signal y_2 . Three points need to be emphasized about this modeling choice. First, note that the monitoring system is reporting on the agent's action rather than on the realized output. However, this is without loss of generality. At its most general, a monitoring system specifies the probabilities from the set of (action, output) pairs to the set of signals. But as long as the output is not contractible, there is no loss of generality in taking the expectation over the output realization and thereby defining the monitoring system in terms of the probabilities of signals, given actions.

¹ See, e.g., Baiman and Demski (1980a, 1980b), Dye (1986), Lambert (1985), Mukherji (1992), and Young (1986). Recently, Suh and Kim (1992) allowed the quality of the monitoring system to be a decision variable.

² Work by Hughes and Conroy (1987) and Lambert (1986) concerns the choice of a costly unconditional pre-decision information system by the agent. Baiman et al. (1987) study unconditional post-decision monitoring in a three-person auditing context.

Second, we assume that, because of cost or other reasons, the principal is restricted to choosing a monitoring system from among those that report only "success" (y_2) or "failure" (y_1). For example, the monitoring system reports whether output produced by the agent passed or failed a quality control test or whether the agent's inferred action was acceptable or not. In the latter interpretation, if the principal wants to induce action a_k , p_k and $1 - p_i$ have natural interpretations as endogenously chosen Type I and Type II errors.³ The principal designs the test with the choice of p_k .

Third, when each feasible monitoring system has only two feasible signals, as in our case, the principal's choice among different monitoring schemes is implicitly a choice among the different implied Type I and Type II errors. Rather than describing the principal's decision problem in terms of these monitoring systems, we describe it directly as a choice of the Type I and Type II errors. To do so merely requires that the set of feasible monitoring systems is sufficiently large to generate all possible (Type I, Type II) error pairs.

The agent has a utility function that is additively separable in wealth and effort, of the form $U(w) - V(a)$, with $U'(\bullet) > 0$ and $U''(\bullet) < 0$, and $V(a_i) < V(a_{i+1})$, $i = 1, \dots, n - 1$. For notational convenience, we will refer to $V(a_i)$ as V_i . The agent's reservation utility for participating in the agency is $\bar{U}$.

III. Investment in Costly Unconditional Monitoring

In this section, we analyze the choice of a costly unconditional post-decision monitoring system. The principal's design problem is to choose the agent's compensation for signal 1 and signal 2 (s_1 and s_2 , respectively) and to choose the probabilities p_i . The cost associated with choosing the vector of p_i s is assumed to be additively separable and identical, that is,

$$C(p_1, \dots, p_n) = \sum_i^n C(p_i),$$

with $C(p_i) \geq 0$. Because a monitoring system with $p_i = 0.5$ is uninformative, we assume, without loss of generality, that $C(p_i = 0.5) = 0$. We further restrict the cost function to be symmetric and convex in p_i , that is, $C(p_i) = C(1 - p_i)$ and $C''(\bullet) > 0$.⁴ One cost function with these properties is $C(p_i) = (p_i - 0.5)^2$. The principal's problem of efficiently motivating the agent to choose some action a_k is represented as:

$$\max_{s_i, p_i} \left[-s_1 p_k - s_2 (1 - p_k) - \sum_i^n C(p_i) \right],$$

such that:

$$U(s_1)p_k + U(s_2)(1 - p_k) - V_k \geq \bar{U}, \quad (\text{IR})$$

$$U(s_1)p_k + U(s_2)(1 - p_k) - V_k \geq U(s_2)(1 - p_i) - V_i \quad \forall i \neq k. \quad (\text{IC})$$

³ An example of the situation being modeled is a monitoring system that consists of the accounting system and the performance measurement system. Each action by the agent, in addition to specifying a probability distribution over the output, specifies a probability distribution over resource use, e.g., action a_k specifies a probability distribution over different raw materials usage, different overhead categories usage, etc. The accounting system aggregates this resource use in some way; it may report only total cost, or total direct material cost and total other costs, etc. The performance measurement system, based upon the accounting aggregation, then identifies whether the agent's action was acceptable or not. Different monitoring systems aggregate the resource use differently, apply different mappings from the aggregations to the signals, and therefore imply different Type I and Type II errors.

⁴ $C(p) = C(1 - p)$ and $C''(\bullet) > 0$ imply $C'(p_i = 0.5) = 0$, $C'(p_i > 0.5) > 0$, and $C'(p_i < 0.5) < 0$.

If a_k were the minimum action, then a constant compensation would be paid to the agent and no monitoring is optimal. Therefore, we will assume that the desired (obedient) action choice a_k is strictly greater than the smallest feasible action choice, a_l .

With the assumption that an interior solution exists, the first-order conditions for s_1 , s_2 , p_k , and p_i are:

$$\frac{1}{U'(s_1)} = \lambda - \frac{\sum_{i \neq k}^n \mu_i (p_i - p_k)}{p_k}; \quad (1)$$

$$\frac{1}{U'(s_2)} = \lambda + \frac{\sum_{i \neq k}^n \mu_i (p_i - p_2)}{1 - p_k}; \quad (2)$$

$$C'(p_k) = -s_1 + s_2 - (\lambda + \sum_{i \neq k}^n \mu_i)(U(s_2) - U(s_1)); \quad (3)$$

$$C'(p_i) = \mu_i (U(s_2) - U(s_1)). \quad (4)$$

We base our analysis on the assumption that $s_2 > s_1$. This assumption is without loss of generality because, for any feasible solution set $(s_1, s_2, \{p_i\}_{i=1, \dots, n})$ where $s_2 < s_1$, there exists an alternative feasible and Pareto equivalent solution set $(s'_1, s'_2, \{p'_i\}_{i=1, \dots, n})$ where $p'_i = 1 - p_i$, $s'_1 = s_2$, and $s'_2 = s_1$.⁵

Notice that, as with Type I and Type II errors, for any fixed cost of monitoring (e.g., for fixed sample size) there is a trade-off between a change in p_i and changes in p_j , $j \neq i$. The following lemmas characterize the optimal solution to the above agency problem.

LEMMA 1. At optimality, $p_k < 0.5$ and $p_i \geq 0.5 \quad \forall i \neq k$.⁶

LEMMA 2. At optimality, $\forall a_s > a_k$, $p_s = 0.5$ and the associated IC constraint is not binding.

LEMMA 3. Let $a_j < a_k$ be the largest action for which the IC constraint is binding. Then, at optimality, $\forall a_z < a_j$, the z th IC constraint is binding and $p_z > p_j > 0.5$.

Lemma 1 orders the probabilities p_j . It establishes that, at optimality, it will never be the case that the probability of generating signal y_1 (or y_2) is the same for the obedient action and some disobedient action. The intuition is quite straightforward. It is most efficient to motivate

⁵ This isomorphism can be seen most clearly when there are only two actions and hence two decision variables, p_1 and p_2 . Then equations (1) and (2), which are derived without any assumptions as to the relative sizes of y_2 , y_1 , s_2 , or s_1 , imply that $p_1 > (<) p_2 \Leftrightarrow s_1 < (>) s_2$. That is, $p_1 > (<) p_2$ implies that y_2 (y_1) is the good signal and, hence, that signal y_2 (y_1) should be the more highly rewarded outcome. Whether one chooses $s_1 < s_2$ or $s_1 > s_2$ is thus just a labeling issue. If one chooses $s_1 < s_2$, as we do, then p_2 can be interpreted as the Type I error and $1 - p_1$ can be interpreted as the Type II error. In contrast, if one chooses $s_1 > s_2$, then $1 - p_2$ can be interpreted as the Type I error and p_1 can be interpreted as the Type II error. However, the inequalities in our results then reverse, which leaves the interpretation of our results in terms of Type I and Type II errors the same.

⁶ The proofs of all results are in the appendix.

the agent by making it more likely that the low payment will be associated with disobedient actions ($p_i \geq 0.5$) than with the obedient action ($p_k < 0.5$). The 0.5 cutoff arises because at $p = 0.5$, the signal is uninformative.

Lemma 2 states that, at optimality, the principal invests *no resources* to monitor actions greater than the obedient action. The result follows from lemma 1. To see this, recall that the agent's expected utility for taking the obedient action, a_k , is $U(s_1)p_k + U(s_2)(1 - p_k) - V_k$. An action greater than a_k would increase the agent's disutility. Further, if the owner devotes no resources to monitoring actions a_s , $s > k$, then, from lemma 1, $p_s = 0.5 > p_k$. But, given that $s_2 > s_1$, choosing an action greater than a_k will decrease the agent's expected utility further. Thus, *not* investing in monitoring for actions a_s , $s > k$ not only saves monitoring costs, it *strengthens* the agent's incentive not to take actions greater than the obedient action.

We know that there must exist some action smaller than the obedient action for which the IC constraint is binding; otherwise, there would be no moral hazard problem. Thus we know that the a_j hypothesized in lemma 3 must exist. Lemma 3 states that the smaller feasible action choices have smaller Type II errors at optimality. The intuition for this follows from the fact that, when all else is held fixed, the agent prefers more shirking to less. To mitigate this, the principal designs the monitoring system to assure that the probability of getting caught shirking is directly related to the level of shirking.

Before introducing the major result of this study, we define the following restriction on the set of utility functions for the agent.

CONDITION 1. *The agent's utility function is such that $\frac{U''(s)}{U'(s)}$ is weakly decreasing in s .*

This condition, which restricts the curvature of the agent's utility function, is satisfied by most common utility functions, such as the logarithmic, the exponential, and, more generally, the HARA (hyperbolic absolute risk aversion) family, with the parameter γ greater than 1 or less than or equal to 0.5. In particular, this condition holds for agents with the *least* relative risk-tolerance.⁷ The condition was used by Baiman and Demski (1980a) (when applied to the HARA class of utility functions) and Dye (1986) as a sufficient condition for the use of lower-tailed monitoring strategies in organizations. Jewitt (1988) proposed it as part of a set of sufficient conditions for the use of the first-order approach to solving agency problems. We have the following result.

PROPOSITION 1. *Given condition 1, at optimality, $p_k < 1 - p_i$ for each $i \neq k$.*

Hence, with a symmetric cost of monitoring, it is optimal to invest in monitoring so that the probability of the Type I error associated with the obedient action is less than the probability of the Type II error for *each* disobedient action choice.

To explain the intuition for proposition 1, we first discuss the role that condition 1 plays in establishing it. Reducing p_k to be less than $1 - p_i$ has two main effects. First, conditional on taking the obedient action, it increases the probability of having to pay the higher compensation (s_2) more often, and thereby increases compensation expense by $(-s_1 + s_2)$. Second, it allows the principal to reduce the spread between s_1 and s_2 , thereby reducing the risk imposed on the agent and the risk premium that must be paid to the agent. Obviously, the less risk-tolerant the agent, the more valuable the second effect and the more likely that it exceeds the

⁷ See Baiman and Demski (1980a) for a discussion of this risk-tolerance interpretation.

first. Condition 1 describes a sufficient amount of risk intolerance for the agent to permit the second effect to dominate, and hence for $p_k < 1 - p_i$ to be optimal.

The principal wants to minimize the cost of implementing a_k . If the agent is very risk-intolerant, a large part of the cost of inducing a_k is the risk premium that must be paid to the agent for the possibility that the monitoring system reports y_1 when the obedient action is taken. For a sufficiently risk-intolerant agent (one who satisfies condition 1), the cost of implementing a_k is minimized by devoting more resources to making sure that the monitoring system identifies when the agent acted obediently, rather than ensuring identification of disobedience (i.e., $1 - p_k > p_i$).

One can interpret this result as saying that it is optimal to motivate the agent by emphasizing the "carrot" versus the "stick." This is in contrast to the *conditional* variance investigation literature in which, for the class of utility functions satisfying condition 1, it is optimal to emphasize the stick versus the carrot (see Baiman and Demski [1980a] and Dye [1986]). The different results are not really contradictory but, rather, noncomparable. In the conditional variance investigation model, the principal has two performance measures, the unconditional and the conditional signal. The result favoring the stick is only with respect to the conditional signal. In the present model, there is only one performance measure, an unconditional signal, and our result favoring the carrot is with respect to that measure.

An implication of proposition 1, lemmas 2 and 3, and the symmetry of the cost function is that

$$C(p_k) > C(p_z) > C(p_j) > C(p_s) = 0, \text{ for } a_z < a_j < a_k < a_s, \quad (5)$$

where a_j is the largest action for which the IC constraint is binding. That is, it is optimal to invest more in the monitoring associated with the obedient action choice than in the monitoring associated with any of the disobedient action choices. Further, the smaller the feasible disobedient action choice, the more one invests in trying to infer its use.

We next study the question of how the optimal signal probabilities vary as the cost of the information system increases. As this is an extremely complex problem to analyze, we restrict ourselves to two possible actions for the agent. We also assume that the agent's utility function is of the form $U(s) = 2\sqrt{s}$. Finally, we specify that the firm's total cost of information is given by $Kx[C(p_1) + C(p_2)]$, where $C(\bullet)$ satisfies all the assumptions made earlier and K is a scalar. We then derive how the optimal values of p_1 and p_2 change as the parameter K varies.

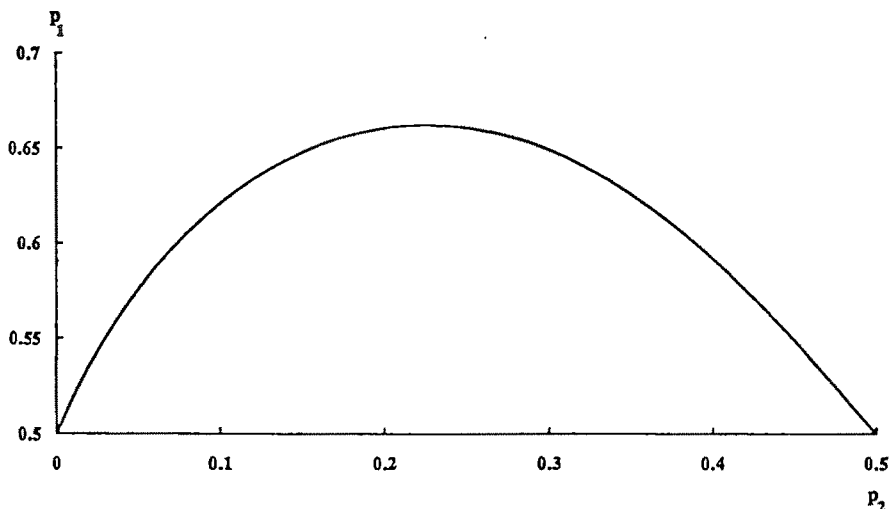
Assuming that an interior solution exists and setting V_1 to 0 and V_2 to 1 (without loss of generality), we get $U(s_1) = \bar{U} + \frac{p_1 - 1}{p_1 - p_2}$ and $U(s_2) = \bar{U} + \frac{p_1}{p_1 - p_2}$. The owner's problem, therefore, is to choose the monitoring probabilities, p_1 and p_2 , to solve the following unconstrained program:

$$\text{Max}_{p_1, p_2} \left[-p_2 U^{-1} \left(\bar{U} + \frac{p_1 - 1}{p_1 - p_2} \right) - (1 - p_2) U^{-1} \left(\bar{U} + \frac{p_1}{p_1 - p_2} \right) - Kx[C(p_1) + C(p_2)] \right]$$

We obtain the following results:

PROPOSITION 2. Assume that $U(s) = 2\sqrt{s}$ and that the total cost of information is given by $Kx[C(p_1) + C(p_2)]$. For every symmetric, convex cost function $C(p)$, the optimal choice of p_2 is an increasing function of K .

Figure 1
Optimal Value of p_1 for a Given p_2



PROPOSITION 3. Assume that $U(s) = 2\sqrt{s}$ and that the total cost of information is given by $Kx[C(p_1) + C(p_2)]$. Further, assume that $C(p)$ is a symmetric, convex cost function and satisfies the restriction that $C'''(\bullet) \leq 0$. Then, the optimal function of p_1 is initially an increasing function of K and later a decreasing function of K , and has a unique peak. Further, p_1 and p_2 increases monotonically towards 1 as K increases.

The sufficient condition used in proposition 3 is a mild curvature assumption that is satisfied, for instance, by any quadratic cost function. To illustrate the proposition, consider the quadratic cost function $C(p) = (p - 0.5)^2$. The optimal value of p_2 lies in the interval $(0, 0.5)$. Figure 1 traces out the optimal value of p_1 for any value that p_2 can take in its feasible range. Each value of K corresponds to one point on the curve in figure 1. Note that, as higher values of p_2 are chosen, the optimal p_1 initially increases but then decreases.

To interpret propositions 2 and 3 better, first note that, from proposition 1, the Type II error always exceeds the Type I error at optimality (i.e., $1 - p_1 > p_2$). As K increases, it is optimal to reduce total monitoring costs. The question is whether to reduce monitoring costs by increasing the Type I error, the Type II error, or both. Proposition 2 indicates that one should always increase the Type I error. However, this will increase the probability that the agent will receive the low payment even if the agent continues to act obediently. To continue to satisfy the IC constraint, the principal would need to either improve the detection of disobedient action (by increasing p_1) or increase $s_2 - s_1$, or both. Proposition 3 establishes sufficient conditions for an increase in p_1 (i.e., a reduction in the Type II error) to be the initial optimal response to an increase in the costliness of monitoring. Thus, the Type I and Type II errors are substitutes at first, in response to increases in the costliness of monitoring. Eventually, as the costliness of monitoring increases, it becomes more efficient to satisfy the agent's IC constraint solely with increases in $s_2 - s_1$ rather than with decreases in the Type II error; at that point, the Type I and Type II errors become complements. Despite the non-monotonicity

of changes in p_1 , the last part of proposition 3 shows that the difference between the Type II and Type I errors decreases monotonically to zero as the cost of information increases.

Propositions 2 and 3 assumed a square-root utility function. Although the expressions for

$$\frac{dp_1}{dK} \quad \text{and} \quad \frac{dp_2}{dK}$$

can be derived for any agent utility function, the signs of the derivatives are much more difficult to establish. To check the robustness of the previous analysis, we numerically solved for the optimal values of p_1 and p_2 with the agent's utility function assumed to be $U(w) = \frac{1}{\gamma} w^\gamma$ and $C(p) = (p - 0.5)^2$, with γ varying from zero to 1. Note that this includes $0.5 < \gamma < 1$, which does not satisfy condition 1, and $0 < \gamma \leq 0.5$, which does. Exactly the same relationships between p_1 , p_2 , $p_1 + p_2$, and K were found to hold as for the $\gamma = 0.5$ case examined in propositions 2 and 3.

IV. Summary and Extensions

The main contribution of this study is that it analyzes the design of monitoring systems, such as managerial accounting and reporting systems, within a more realistic context than previously modeled. In particular, when designing a monitoring system, the system designer cannot assume that the users of the system will have access to costless, objectively verifiable, and informative signals of the agent's behavior.

We addressed this issue by looking at the optimal design of an unconditional costly monitoring system. We found that, at optimality, the Type I error associated with the obedient action is less than the Type II error associated with any disobedient action. Further, we characterized how the optimal Type I and Type II errors change with changes in the costliness of the monitoring system.

Future work may attempt to generalize some of the results in this study. For instance, given the consistency of the numerical results with respect to the effect of changes in K on the optimal monitoring investment strategy, it might be possible to generalize our results to utility functions other than the square root. Another area for future work is to analyze the effect of relaxing a second common assumption underlying agency models, that the production process is exogenously fixed. By designating both the production process and the monitoring system as choice variables, one could study the trade-offs in designing the two systems.

Appendix

Proof of Lemma 1

The first-order conditions for s_1 , s_2 , p_k , and p_i give:

$$\frac{1}{U'(s_1)} = \lambda - \frac{\sum_{i=k}^n \mu_i (p_i - p_k)}{p_k}; \quad (A1)$$

$$\frac{1}{U'(s_2)} = \lambda + \frac{\sum_{i=k}^n \mu_i (p_i - p_k)}{1 - p_k}; \quad (A2)$$

$$C'(p_k) = s_2 - s_1 - \left(\lambda + \sum_{i \neq k}^n \mu_i \right) (U(s_2) - U(s_1)); \quad (A3)$$

$$C'(p_i) = \mu_i (U(s_2) - U(s_1)). \quad (A4)$$

We will first establish that $p_i \geq \frac{1}{2} \forall i \neq k$. Because the inequality constraints are greater than or equal to, we know that all of the Lagrange multipliers will be greater than or equal to zero. Therefore, from equation (A4), for $i \neq k$, $C'(p_i)$ will either have the same sign as $(s_2 - s_1)$ or be equal to zero. Hence, for all

$$\mu_i = 0, C'(p_i) = 0 \Leftrightarrow p_i = \frac{1}{2}, \text{ and for all } \mu_i > 0, s_2 > (<) s_1 \Leftrightarrow C'(p_i) > (<) 0 \Leftrightarrow p_i > (<) \frac{1}{2} \text{ for } i \neq k.$$

As explained in the text, we will assume, without loss of generality, that $s_2 > s_1 \Leftrightarrow p_i \geq \frac{1}{2} \forall i \neq k$.

Establishing $p_k < 0.5$ is equivalent to establishing that $C'(p_k) < 0$, or, from equation (A3), that

$$\frac{s_2 - s_1}{(U(s_2) - U(s_1))} < \left(\lambda + \sum_{i \neq k}^n \mu_i \right).$$

Because $U(\bullet)$ is concave and $s_2 > s_1$, we have

$$\frac{s_2 - s_1}{(U(s_2) - U(s_1))} < \frac{1}{U'(s_2)}.$$

Hence,

$$\begin{aligned} \frac{s_2 - s_1}{(U(s_2) - U(s_1))} &< \frac{1}{U'(s_2)} = \lambda + \frac{\sum_{i \neq k}^n \mu_i (p_i - p_k)}{1 - p_k} = \lambda + \frac{\sum_{i \neq k}^n \mu_i (p_i - 1 + 1 - p_k)}{1 - p_k} \\ &= \lambda + \sum_{i \neq k}^n \mu_i + \frac{\sum_{i \neq k}^n \mu_i (p_i - 1)}{1 - p_k} < \lambda + \sum_{i \neq k}^n \mu_i, \end{aligned}$$

where the first equality follows from equation (A2) and the last inequality follows from the interior solution assumption that implies $p_i < 1$.

Q.E.D.

Proof of Lemma 2

Again, without loss of generality, $s_2 > s_1$, and hence, from lemma 1, we know that $p_i \geq \frac{1}{2} > p_k \forall i \neq k$. Consider a particular $a_s > a_k$. From $p_s \geq \frac{1}{2} > p_k$ and $s_2 > s_1$, we know that

$$\begin{aligned} U(s_1)p_k + U(s_2)(1 - p_k) &> U(s_1)p_s + U(s_2)(1 - p_s) \\ \Rightarrow U(s_1)p_k + U(s_2)(1 - p_k) - V_k &> U(s_1)p_s + U(s_2)(1 - p_s) - V_s. \end{aligned}$$

This implies that the Lagrange multiplier for the s th constraint cannot be positive, and hence that $p_s = 0.5$.

Q.E.D.

Proof of Lemma 3

We know that $s_2 > s_1$ and, hence, from lemma 1, $p_i \geq 0.5 > p_k \forall i \neq k$. Because the a_j IC constraint is binding, $p_j > 0.5$. Suppose there exists another action a_z such that $a_z < a_j < a_k$. Then:

$$\begin{aligned} U(s_1)p_z + U(s_2)(1-p_z) - V_z &\leq U(s_1)p_k + U(s_2)(1-p_k) - V_k \\ &= U(s_1)p_j + U(s_2)(1-p_j) - V_j \\ &< U(s_1)p_j + U(s_2)(1-p_j) - V_z \\ \Rightarrow [U(s_1) - U(s_2)](p_z - p_j) &< 0 \\ \Rightarrow (p_z - p_j) &> 0 \\ \Rightarrow p_z > p_j > 0.5 &\Rightarrow \mu_z > 0, \end{aligned}$$

where the latter implies that the a_z IC constraint is binding, which establishes the lemma.

Q.E.D.

Proof of Proposition 1

Adding equations (A3) and (A4) gives

$$C'(p_k) + C'(p_j) = [-s_1 + s_2 - \lambda(U(s_2) - U(s_1))] - \left[\sum_{i \neq k \text{ or } j}^n \mu_i (U(s_2) - U(s_1)) \right]. \quad (\text{A5})$$

The term in the second brackets on the right-hand side (RHS) of equation (A5) is non-negative. By using equations (A1) and (A2), the term in the first brackets can be rewritten as

$$\begin{aligned} -s_1 + s_2 - \left(\frac{p_k}{U'(s_1)} + \frac{1-p_k}{U'(s_2)} \right) [U(s_2) - U(s_1)] \\ < -s_1 + s_2 - \frac{1}{2} \left(\frac{1}{U'(s_1)} + \frac{1}{U'(s_2)} \right) [U(s_2) - U(s_1)], \end{aligned} \quad (\text{A6})$$

where the inequality follows from $p_k < 0.5$ and $s_2 > s_1$.

The following lemma establishes that the RHS of equation (A6) is nonpositive, which implies that the RHS of equation (A5) is negative.

Lemma. If $U(\bullet)$ satisfies condition 1, then for any two numbers a and b where $a \leq b$,

$$-a + b - \frac{1}{2} \left(\frac{1}{U'(a)} + \frac{1}{U'(b)} \right) [U(b) - U(a)] \leq 0. \quad (\text{A7})$$

Proof

For $a = b$, the left-hand side (LHS) of equation (A7) equals 0. Thus, if $\frac{d}{da} [\text{LHS}(\text{A7})] \geq 0 \forall a \leq b$, we have the desired result. Differentiating the LHS of equation (A7) gives:

$$\frac{d}{da} [\text{LHS}(\text{A7})] = -\frac{1}{2} \left(1 - \frac{U'(a)}{U'(b)} - [U(b) - U(a)] \frac{U''(a)}{U'(a)^2} \right). \quad (\text{A8})$$

To establish the lemma, we need to show that the RHS of equation (A8) $\geq 0 \forall b \geq a$. At $b = a$, $\text{RHS (A8)} = 0$. Hence the desired result can be established by showing that $\frac{d}{db}[\text{RHS(A8)}] \geq 0, \forall b \geq a$. Differentiating RHS (A8) with respect to b yields

$$\begin{aligned} \frac{d}{db}[\text{RHS(A8)}] &= -\frac{1}{2} \left(\frac{U'(a)U''(b)}{U'(b)^2} - \frac{U'(b)U''(a)}{U'(a)^2} \right) \\ &= -\frac{1}{2} \left(\frac{U'(a)^3 U''(b) - U'(b)^3 U''(a)}{U'(a)^2 U'(b)^2} \right). \end{aligned}$$

Condition 1 and $b \geq a$ imply that, $\frac{U''(a)}{U'(a)^3} \geq \frac{U''(b)}{U'(b)^3}$ that is, $U'(a)^3 U''(b) \leq U'(b)^3 U''(a)$, which implies that $\frac{d}{db}[\text{RHS(A8)}] \geq 0$. Hence, $\text{RHS (A8)} \geq 0$ for $b \geq a$, implies that $\frac{d}{da}[\text{LHS(A7)}] \geq 0 \forall b \geq a$, which, in turn, implies that $\text{LHS (A7)} \leq 0 \forall b \geq a$, and establishes the desired result.

Q.E.D.

The lemma establishes that RHS (A5) is negative, and hence that, for $s_2 > s_1$,

$$C'(p_k) + C'(p_j) < 0.$$

Together with the convexity and symmetry of the cost function, this implies that $p_k < 1 - p_j$ for every disobedient action choice a_j .

Q.E.D.

Proof of Proposition 2

Let L be the objective function of the owner. The sign of $\frac{dp_2}{dK}$ is given by the sign of

$$\left(-\frac{\partial^2 L}{\partial p_1 \partial p_2} \right) C'(p_1) + \left(\frac{\partial^2 L}{\partial p_1^2} \right) C'(p_2).$$

Expanding this and substituting for K from the first-order condition on p_1 , we can show that $\frac{dp_2}{dK}$ has the same sign as the following expression:

$$-p_2(1-p_2)C'(p_2) \left(3 + (p_1 - p_2) \frac{C''(p_1)}{C'(p_1)} \right) + C'(p_1) [2p_1 p_2 - 2p_2 - p_1 + p_2^2]. \quad (\text{A9})$$

Extensive simplification of the first-order condition on p_2 shows that the following relationship between the chosen values of p_1 and p_2 must hold at optimality:

$$C'(p_1) [2p_1 p_2 - p_2 - p_1] = 2p_2(1-p_2)C'(p_2). \quad (\text{A10})$$

Substituting this into equation (A9) yields:

$$p_2(1-p_2) \left(-C'(p_2) \left(1 + (p_1 - p_2) \frac{C''(p_1)}{C'(p_1)} \right) - C'(p_1) \right).$$

As $U(s) = 2\sqrt{s}$ satisfies condition 1, we have $-C'(p_2) > C'(p_1) > 0$; further, $(p_1 - p_2) \frac{C''(p_1)}{C'(p_1)} > 0$. Therefore, (A9) > 0 , which implies that $\frac{dp_2}{dK} > 0$ everywhere.

Q.E.D.

Proof of Proposition 3

To begin, note that for any symmetric cost function, $C'''(p_1 = 0.5) = 0$. Further, $C'''(\bullet) \leq 0$ implies that $C'''(p_1 < 0.5) \geq 0$ and $C'''(p_1 > 0.5) \leq 0$. Now as p_2 is monotonically increasing in K , it is sufficient to consider the relationship between the optimal values of p_1 and p_2 . Consider equation (A10) as an identity, that is,

$$f(p_1, p_2) = C'(p_1)[2p_1p_2 - p_2 - p_1] - 2p_2(1 - p_2)C'(p_2) = 0.$$

Now, $\frac{\partial f}{\partial p_1} = C'(p_1)[2p_2 - 1] + C''(p_1)[2p_1p_2 - p_2 - p_1] < 0$. Thus, $\text{Sign } [p'_1(p_2)] = \text{Sign} \left(\frac{\partial f}{\partial p_2} \right)$, which is given by:

$$g(p_1, p_2) \equiv \frac{\partial f}{\partial p_2} = C'(p_1)[2p_1 - 1] - 2p_2(1 - p_2)C''(p_2) - 2(1 - 2p_2)C'(p_2).$$

Note that

$$\frac{\partial g}{\partial p_2} = -2p_2(1 - p_2)C'''(p_2) - 4(1 - 2p_2)C''(p_2) + 4C'(p_2) < 0,$$

where the inequality follows because: $C''(p_2) > 0$ (by convexity), $C'''(p_2) \geq 0$ (from our assumption on $C'''(\bullet)$ and $p_2 < 0.5$) and $C'(p_2) < 0$ (from $p_2 < 0.5$). Further,

$$\frac{\partial g}{\partial p_1} = 2C'(p_1) + (2p_1 - 1)C''(p_1) > 0.$$

Now, as

$$\begin{aligned} p_2 \rightarrow 0, g(\cdot) &\rightarrow C'(p_1)[2p_1 - 1] - 2C'(0) > 0. \text{ As } p_2 \rightarrow 0.5, g(\cdot) \\ &\rightarrow C'(p_1)[2p_1 - 1] - \frac{1}{2}C''(0.5) < C'(1) - \frac{1}{2}C''(0.5) \leq 0. \end{aligned}$$

The last inequality follows from $C'(p = 0.5) = 0$ and $C'(\cdot)$ weakly concave in the region $(0.5, 1)$. The latter follows from the assumption that $C'''(\bullet) \leq 0$.

Thus, p_1 is an increasing function of p_2 at lower levels of p_2 , and is decreasing at higher levels of p_2 . It has a unique peak because otherwise there must exist at least three points at which $g(\cdot) = 0$. In particular, if p_1 has its first peak at (p_1^*, p_2^*) ($\Rightarrow g(p_1^*, p_2^*) = 0$), there must exist some $(\hat{p}_1, \hat{p}_2)$ that satisfies $\hat{p}_2 > p_2^*$, $\hat{p}_1 \leq p_1^*$ and $g(\hat{p}_1, \hat{p}_2) = 0$. But this obviously cannot hold because $g(\cdot)$ is increasing in p_1 and decreasing in p_2 . We therefore have a contradiction, which implies that p_1 is unimodal in p_2 , and, hence, unimodal in K .

To show that $p_1 + p_2$ is always increasing, it is sufficient to show that $p'_1(p_2) > -1$, that is, $\frac{\partial f}{\partial p_2} - \frac{\partial f}{\partial p_1} > 0$. This reduces to showing that

$$2C'(p_1)[p_1 - p_2] - 2p_2(1 - p_2)C''(p_2) - 2(1 - 2p_2)C'(p_2) - C''(p_1)[2p_1p_2 - p_2 - p_1] > 0.$$

As the first and third terms are positive, it is sufficient to show that

$$C''(p_1)[p_1 + p_2 - 2p_1p_2] \geq 2p_2(1 - p_2)C''(p_2),$$

which is equivalent (from equation (A10)) to showing that

$$\frac{-C'(p_2)}{C'(p_1)} \geq \frac{C''(p_2)}{C''(p_1)}.$$

We know that $C'(p_1) + C'(p_2) < 0$; that is, the LHS of the expression strictly exceeds 1. Further, as $C''(\bullet)$ is weakly increasing in the region $(0, 0.5)$ from our assumption on $C'''(\bullet)$, $p_2 < 1 - p_1 \Rightarrow C''(1 - p_1) = C''(p_1)$, where the last equality follows from $C(\bullet)$'s symmetry. The RHS of the above expression is thus at most 1, which gives us the desired inequality.

Q.E.D.

References

- Aron, D. J., and P. Olivella. 1991. Bonuses and penalties as equilibrium incentive devices, with application to manufacturing systems. Working paper, J. L. Kellogg Graduate School of Management, Northwestern University, Evanston, IL.
- Baiman, S., and J. Demski. 1980a. Economically optimal performance evaluation and control systems. *Journal of Accounting Research* 18 (Supplement): 184-220.
- _____, and _____. 1980b. Variance analysis procedures as motivational devices. *Management Science* 26 (6): 840-48.
- _____, J. H. Evans III, and J. C. Noel. 1987. Optimal contracts with a utility-maximizing auditor. *Journal of Accounting Research* 25 (2): 217-44.
- Dye, R. A. 1986. Optimal monitoring policies in agencies. *The RAND Journal of Economics* 17 (Autumn): 339-50.
- Hughes, J. S., and R. M. Conroy. 1987. Delegating information-gathering decisions. *The Accounting Review* 62 (January): 50-66.
- Jewitt, I. 1988. Justifying the first-order approach to principal-agent problems. *Econometrica* 56 (5): 1177-90.
- Lambert, R. A. 1986. Executive effort and selection of risky projects. *The RAND Journal of Economics* 17 (1): 77-88.
- _____. 1985. Variance investigation in agency settings. *Journal of Accounting Research* 23 (Autumn): 633-47.
- Mukherji, A. 1992. Costly monitoring in a principal-agent model. Working paper, University of Minnesota, Minneapolis, MN.
- Suh, Y. S., and S. K. Kim. 1992. Conditional monitoring policy under moral hazard. *Management Science* 38 (8): 1106-20.
- Young, R. A. 1986. A note on "economically optimal performance and control systems": The optimality of two-tailed investigations. *Journal of Accounting Research* 8 (1): 231-40.

Earnings Management in Response to Corporate Tax Rate Changes: Evidence from the 1986 Tax Reform Act

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SYNOPSIS AND INTRODUCTION: This study investigates whether accounting earnings of U.S. corporations are managed in response to changes in the statutory corporate income tax rate. The Tax Reform Act of 1986 (TRA) reduced the maximum corporate tax rate from 46 percent to 34 percent. If managers attempt to maximize firm value by minimizing tax costs, this tax rate change would have provided a substantial incentive to defer income.

The motivation for this study comes from attempts by previous researchers to identify situations in which incentives to manage earnings exist and to find empirical evidence of such management (Healy 1985; DeAngelo 1986; Liberty and Zimmerman 1986; McNichols and Wilson 1988; Jones 1991; Cahan 1992). Evidence of earnings management is examined by focusing on accounting accruals. As pointed out by Manzon (1992) and Choi et al. (1991), total accruals can be separated into those types of accruals that are not expected to have a significant effect on taxable income (called "non-current accruals," e.g., depreciation) and those types of accruals that are expected to affect taxable income (called "current accruals," e.g., accounts receivable, accrued payables). By knowing ex-ante which types of accruals are most likely to affect tax savings, more powerful tests of tax motivated earnings management are possible. Firms expected to reduce financial statement income to achieve tax savings are large firms, firms with low levels of long-term debt, and firms with high levels of manager ownership.

While the reduction in corporate tax rates provided an incentive for managers to decrease financial statement income in the year prior to the effective date of

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TRA, other incentives might make it costly for managers to do so. For this reason, many firms may choose to forego a current tax savings to avoid reducing financial statement net income.

The results of empirical tests report significantly lower current accruals for large firms for the year prior to the tax rate reduction.¹ As predicted, these accruals are positively associated with levels of long-term debt. There is no relation between accruals and manager ownership. Accruals for large firms with years ending 30 June are not lower than those of calendar year firms.

This study provides evidence of management of financial statement income in response to a large decrease in the statutory corporate tax rate. The results have implications for independent auditors, who face conflicting incentives to (1) provide clients with tax minimization advice, and (2) detect material cases of client earnings management. The results are also expected to be of interest to tax policy decision makers, since the ability of corporate managers to engage in tax rate arbitrage through earnings management can affect revenue estimates, as well as estimates of effects of tax law changes.

Key Words: *Accruals, Tax Reform Act, Earnings management.*

Data Availability: *Available on request from the author.*

THE balance of this study is organized as follows. Section I discusses the concept of earnings management as it relates to the tax rate reductions in the TRA. Five hypotheses are also developed in this section. Section II discusses the operationalization of the hypotheses and describes the sample selection process. Section III reports the results of empirical tests of the hypotheses, and section IV concludes the study.

I. Earnings Management and Tax Rate Changes

The Relation between Management of Taxable Income and Financial Accounting Income

The Tax Reform Act of 1986, enacted in September 1986, reduced the statutory corporate income tax rate from 46 percent to 34 percent, effective for taxable years beginning on or after 1 July 1987. This represents a reduction of 26 percent of the pre-TRA tax expense. Deferring \$1.00 of taxable income from a year in which it would be taxed at the pre-TRA rate to a year in which it would be taxed at the post-TRA rate would be equivalent to earning 22 percent [i.e., $1.00 \times (1 - 0.34) = 1.22 \times (1 - 0.46)$]. If managers attempt to minimize the tax expense of the firm, this rate reduction provides a substantial incentive for the management of taxable income.²

In addition to the statutory tax rate reduction, there are other provisions in the TRA that provide incentives to manage taxable income. For example, the "uniform capitalization rules" require the capitalization for tax purposes of certain costs associated with property held for resale

¹ Although Scholes et al. (1992) do not look at accounting accruals, they examine changes in fourth quarter gross profit and selling, general, and administrative expenses around the TRA. The results reported in this study are consistent with their findings.

² There is anecdotal evidence that tax planning publications were advocating such tax planning strategies to their readers. For example, the *Research Institute of America Explanation of the 1986 Tax Reform Act* recommended (p. 10): "In order to take the greatest advantage of the reduced rates for corporations, consider accelerating deduction[s] into tax years beginning before July 1, '87 and postponing income into tax years beginning on and after July 1, '87."

and property constructed by the taxpayer. These rules apply to costs incurred after 31 December 1986 in tax years ending after that date. Therefore, by accelerating costs from 1987 to 1986, a firm could avoid capitalizing such costs under the new tax rules. In another example, the TRA eliminated the allowance method for bad debts effective for years after 1986. To minimize the impact of this change, firms had an incentive to maximize their allowance for doubtful accounts at the end of 1986.

Although the TRA provisions provided a strong incentive for management of taxable income, taxable income is not directly observable by researchers, and therefore the focus of this study is on management of financial statement income. The accounting research issue addressed is whether the deferral of revenue or acceleration of expenses for tax purposes also results in changes to financial statement pre-tax income. There are numerous differences between taxable income and financial statement pre-tax income. However, by examining the statutory rules contained in the Internal Revenue Code and Treasury Department Regulations and Generally Accepted Accounting Principles,³ it is apparent there will be some relation between the two sets of accruals.

The accrual method of accounting for financial statement purposes requires expense recognition in the accounting period in which the expense is incurred.⁴ In addition, under the matching principle some expenses (e.g., warranty claims) are estimated and recorded before they are incurred, in order to match them against the revenue that was generated by the expense. In contrast to these rules, an item may not be deducted for tax purposes until three conditions are satisfied. First, under the "all events" test, all of the events that determine the taxpayer's liability for the expense must have occurred. Second, also under the all events test, the amount of the taxpayer's liability must be determined with reasonable accuracy. Third, before an item of expense may be accrued, "economic performance" must have occurred. In the case of a liability of a taxpayer that requires a payment for property or services, economic performance is deemed to occur as the property or services are provided to the taxpayer.

If a manager wants to accelerate a tax deduction from a future year into the current year to reduce taxable income, he or she must not only fix the liability for the expense in the current year and be able to reasonably estimate the expense but must also accelerate the economic performance of the expense into the current year. If all of these three conditions are accomplished, the expense will be deductible for tax purposes in the current year but will also be properly accrued in the current year for financial statement purposes. Thus, deductibility of an accrued expense for tax purposes appears to be a sufficient, but not a necessary, condition for accrual of the expense for financial statement purposes. In view of this result, it is expected that in the absence of a particular statutory tax provision allowing earlier deduction, managers who accelerate accrued expenses for tax purposes will likely be accelerating financial statement expenses as well.

In addition to accelerating expenses, managers can also defer taxable income by deferring the recognition of revenue. A manager attempting to defer taxable income would defer revenue by delaying the occurrence of "all events" that determine the taxpayer's right to receive the revenue, such as delaying shipments of goods so that title has not passed at year-end. By delaying the taxpayer's right to receive the revenue, the revenue would not be realizable nor earned at year-end for financial accounting purposes; therefore, the revenue would also be deferred on the

³ Even examining the income tax footnote reconciliation of pretax book income with the statutory tax rate will not reveal all of the differences between taxable income and financial statement income, since only material differences are required to be disclosed. See Wilkie (1988) for a discussion of this issue in connection with effective tax rates.

⁴ Note that under both tax and GAAP rules costs that are in the nature of inventory, or that result in an asset having a useful life of longer than one year must be capitalized.

financial statements. Like the treatment of expenses, deferral of revenue for tax purposes appears to be a sufficient but not a necessary condition for deferral of the revenue for financial statement purposes as well. These different book and tax rules reflect the different incentives that underlie financial and tax accounting. Under the conservatism convention, accountants generally try to avoid overstating revenues or understating expenses. In order to protect the government's revenues, the tax rules are designed to prevent taxpayers from understating revenues or overstating expenses. Based on this analysis, firms that defer taxable income will in many cases be deferring financial statement income as well.⁵

Earnings Management and Accounting Accruals

Prior work on earnings management has focused primarily on what are called accounting accruals, which are the differences between accounting earnings and cash flows from operations. According to Healy (1985), accruals modify the timing of reported earnings and are composed of discretionary accruals that enable the manager to transfer earnings between periods and of nondiscretionary accruals that are mandated by accounting standard-setting bodies.

For purposes of this study, it is important to recognize that accruals reflect financial statement income and expenses, while tax-motivated income management requires changing taxable income and deductions. Recognizing this difference, Manzon (1992) and Choi et al. (1991) separate accruals into those types that are not expected to have a significant effect on taxable income and those types of accruals that are expected to affect taxable income. Following the terminology in Choi et al., the first type are called "non-current accruals" and are represented by such items as depreciation, and the equity earnings of unconsolidated subsidiaries. The second type are called "current accruals" and are represented by such items as accounts receivable and accrued payables. Since this study is concerned with management of taxable income, only current accruals will be used in the empirical tests.

The definition of current accruals for firm i in year t ($CACC_{it}$) is:

$$CACC_{it} = (CA_{it} - CA_{it-1}) - (CL_{it} - CL_{it-1}), \quad (1)$$

where CA is current assets (other than cash) and CL is current liabilities. The changes in the current asset and current liability accounts represent differences between financial statement net income and cash flows from operations, exclusive of those differences that are not expected to affect taxable income (e.g., depreciation). Assume that, in the absence of earnings management, current assets and current liabilities at time t are both a function of total sales at time t ($SALES_{it}$), such that:

$$CA_{it} = \alpha_i^A + \beta_i^A SALES_{it} + \varepsilon_{it}^A \quad \text{and} \quad CL_{it} = \alpha_i^L + \beta_i^L SALES_{it} + \varepsilon_{it}^L, \quad (2)$$

where ε_{it}^A and ε_{it}^L are random error terms. Substituting equations (2) into equation (1) results in a model of expected current accruals in the absence of earnings management, as a function of the change in sales:

$$CACC_t = \beta_i^A \Delta SALES_{it} + \varepsilon_{it}^A - \varepsilon_{it-1}^A - \beta_i^L \Delta SALES_{it} - \varepsilon_{it}^L + \varepsilon_{it-1}^L \quad (3)$$

$$CACC_t = \beta_i \Delta SALES_{it} + \varepsilon_{it}, \quad (4)$$

⁵ This deferral of income may be offset for financial statement purposes by the acceleration of other income that has no tax effect (e.g., reducing warranty reserves). Therefore, any tax related deferral is expected to be difficult to detect empirically.

where ΔSALES_{it} is the change in sales for firm i in year t ; $\beta_1 = \beta_1^A - \beta_1^L$; and

$$\varepsilon_{it} = \varepsilon_{it}^A - \varepsilon_{it-1}^A - \varepsilon_{it}^L + \varepsilon_{it-1}^L.$$

Note that equation (4) is similar to the accruals model in Jones (1991), except that Jones's model also includes a term for property, plant, and equipment, since Jones was using total accruals as the dependent variable, and total accruals includes depreciation. Also, unlike the Jones model, equation (4) has no constant term.⁶

Development of Hypotheses

Based on equation (1), decreasing current assets to defer revenue or increasing current liabilities to accelerate expenses (or both) will cause accruals to be negative. Therefore, if managers use accounting accruals to defer taxable income in anticipation of a reduction in tax rates, current accruals in the year immediately preceding the year of the rate reduction will be negative. This leads directly to the first hypothesis:

H1: Firms will have negative current accruals in the year preceding the TRA tax rate reduction.

One potential problem with studying the effect of the rate reduction on earnings management is the fact that, for most firms, the entire reduction was not realized in one year. The new rate took effect for taxable years beginning on or after 1 July 1987. This means that for a calendar year firm, the new (34 percent) rate would not be effective until 1988. However, the law provided transitional rules for those years that included 1 July 1987. In those cases, the tax rate for the transitional year is equal to a weighted average of the new rate and the old rate, where the weights are the number of months before and after 1 July 1987. Thus, the tax rate was effectively reduced by 1 percent per month beginning with July 1987. Under these rules a calendar year firm would receive the 12 percent reduction in the statutory tax rate over two years, with 6 percent being received in 1987, and 6 percent received in 1988. For a 30 September year-end firm, the reduction is realized as 3 percent in the year ending September 1987, and 9 percent in the year ending September 1988. Only firms with a 30 June year-end realized the entire 12 percent decrease over a single year (the year ending June 1987 to the year ending June 1988).

This transitional rule has important implications for the design of the empirical tests in this study. To realize the full 12 percent rate reduction, all firms other than 30 June year-end firms would have to defer income over two year-ends. Assume that there are nontax costs associated with the deferral of income from one year to another. (These nontax costs are important to the design of this study and are discussed more fully below.) Under this assumption, firms would not defer income if the nontax cost of the deferral exceeds the tax savings. Therefore, a June year-end firm may be observed deferring income while firms with other year-ends (and smaller tax savings) would not. This leads to the second hypothesis:

H2: Firms with June year-ends will be more likely than other firms to have negative current accruals in the year preceding the TRA tax rate reduction.

⁶ In empirical tests, the model was also estimated after including an intercept term. The mean intercept across all firms was negative and was not significantly different from zero. The results of empirical tests were reestimated using parameters from the model including an intercept, and the results are essentially the same as those reported.

In discussing the role of tax minimization in explaining the behavior of firm managers, Scholes and Wolfson (1986, 1989) assert that managers attempt to mitigate rather than minimize tax costs, since the goal of tax minimization often conflicts with the goal of transaction cost minimization. This means that, even for those 30 June year-end firms for which the tax benefit of the rate decrease is expected to be realized over one year-end, all firms will not respond to the tax rate decrease. This is because the nontax costs of income deferral are expected to differ cross-sectionally, and only those firms for which the nontax costs are less than the tax decrease will be expected to defer income.

There are two different types of nontax costs that are associated with the deferral of income. The first type consists of direct costs of the actual deferral, such as the cost of dissatisfied customers if year-end shipments are delayed to defer sales; the costs associated with the acceleration of R&D projects, such as start-up costs, crowding, overtime premiums, and financing costs; and the expected legal and accounting costs of future challenges by Internal Revenue Service auditors. In this study, this type of nontax cost is not expected to differ cross-sectionally and is therefore not controlled for in the empirical tests.⁷

The second type of nontax costs are those associated with the reduction in financial statement earnings caused by the deferral. If firms defer taxable income by deferring shipments of sales, or accelerating repairs or R&D, this also reduces the net income reported on the firm's financial statements.⁸ This reduction in financial statement net income may impose nontax costs on the firm or its managers. The nontax costs investigated in this study are political costs, costs of violating debt covenant restrictions, and costs associated with management compensation plans.

Prior research (e.g., Watts and Zimmerman 1978) has suggested that larger firms may be more sensitive to political costs and therefore more likely to use accounting methods that decrease financial statement net income. If these politically sensitive firms attempt to reduce current taxes by deferring taxable income, they are expected to also reduce financial statement income in order to minimize any potential political costs that may arise if their tax reduction behavior is subject to public scrutiny. The expectation that large (i.e., politically sensitive) firms will be more likely to reduce financial statement income as well as defer taxable income in response to the tax rate reductions results in the following hypothesis:

- H3: Current accruals in the year preceding the 1986 tax rate reduction will be negatively related to firm size.

The debt covenants' hypothesis and use of income increasing accounting methods is summarized in Watts and Zimmerman (1986). Because of the use of accounting numbers in debt covenants with lenders, firms that are closer to violation of debt covenant agreements may be unwilling to reduce financial statement net income to reduce taxes, which leads to the following hypothesis:

- H4: Current accruals in the year preceding the 1986 tax rate reduction will be positively related to debt levels.

⁷ Even though this type of nontax cost is not expected to differ cross-sectionally, the net (after-tax) benefit from the deferral will still differ cross-sectionally for firms with different year-ends because of the transitional rate reductions.

⁸ It may be possible for firms to defer taxable income without affecting financial statement income (e.g., the use of installment sales), in which case they would not be subject to the second type of nontax cost. However, this behavior would not be detected using financial statement income and is therefore not investigated in this study.

Hunt (1985) and Niehaus (1989) discuss the conflicting incentives that can arise between managers and shareholders in the choice of the LIFO inventory accounting method. In firms where management compensation is positively related to reported financial statement income, the reduction in income caused by the adoption of LIFO can harm managers, even though the reduction in taxable income (and the resulting tax savings) benefits shareholders. Both Hunt and Niehaus predict that these conflicting incentives will be reduced in those cases in which managers have a large ownership interest in the firm. Applying this same reasoning to the decision to defer taxable income in response to tax rate changes, it is expected that those firms with high levels of manager ownership will be more likely to shift financial statement income in order to reduce taxes.⁹ This results in the following hypothesis:

H5: Current accruals in the year preceding the 1986 tax rate reduction will be negatively related to levels of manager ownership.

II. Operationalizing the Hypotheses and Sample Selection

Operationalizing the Hypotheses

The five hypotheses developed in the previous section are all stated in terms of firms' current accruals. The measure of current accruals used is based on Jones (1991) as follows:¹⁰

$$CACC_t = [\Delta \text{Current Assets}_t - \Delta \text{Cash}_t] - [\Delta \text{Current Liabilities}_t - \Delta \text{Current Maturities of Long-term Debt}_t - \Delta \text{Income Taxes Payable}_t], \quad (5)$$

where the change (Δ) is computed between time t and time $t-1$.

As pointed out by Healy (1985), some accruals are nondiscretionary and are not likely to be affected by managers' attempts to defer income. To control for these nondiscretionary accruals, the measure of earnings management used in this study is the difference between actual current accruals for the year and the expected current accruals based on the relation in equation (4).¹¹

Before estimating equation (4), all of the variables in the model are deflated by beginning of the year total assets (A_{it-1}) to reduce heteroscedasticity. This results in the following empirical model:

$$CACC_{it}/A_{it-1} = \beta_1 [\Delta \text{SALES}_{it}/A_{it-1}] + \varepsilon_{it}. \quad (6)$$

The parameters of equation (6) are estimated using a separate OLS regression for each sample firm over the thirteen-year period 1972 through 1984. Summary statistics from estimating these regressions are presented in table 1. Table 1 reports that the mean R^2 from these regressions is 0.381 for calendar year firms and 0.474 for June year-end firms, which are both higher than those

⁹ Note that the LIFO choice can result in an indefinite reduction of financial statement earnings. Therefore, the relation between management ownership and the LIFO decision may be much stronger than that involving deferral of current accruals.

¹⁰ The change in taxes payable is subtracted from the calculation of current accruals in equation (5), since this study is concerned with management of pretax rather than net income.

¹¹ Because the test statistics are based on this accruals expectation model, the tests are really joint tests of earnings management and the accruals model in equation (4). Also, to the extent that firms managed accruals to influence public opinion during the long congressional debate on the TRA, accruals for 1985 may also be affected.

reported in Jones (1991).¹² Because these are time series regressions, Durbin Watson statistics are calculated to determine the degree of autocorrelation in the residuals.¹³ For the calendar year firms, the Durbin Watson null hypothesis of $\rho = 0$ is rejected at the 0.05 level for 10 firms (3 for positive and 7 for negative autocorrelation). For the June year-end firms the null hypothesis is rejected for 2 firms (1 for positive and 1 for negative autocorrelation). Based on these results, autocorrelation of the residuals does not appear to be a serious problem.¹⁴

Sample Selection

The five hypotheses developed above are tested using financial statement data from a sample of firms taken from the 1990 COMPUSTAT Annual Industrial file. Only firms in the manufacturing, wholesale, retail, and services (other than financial services) industries are included in the sample.¹⁵ Firms without complete COMPUSTAT data necessary to estimate equation (6) for the years 1972 through 1988 are excluded from the sample. To test hypothesis H2, the sample is divided into two smaller samples: firms with calendar year-ends and firms with fiscal years ending in May, June, or July.¹⁶ Firms are eliminated from the sample if they are incorporated in countries other than the United States, or if they changed fiscal year-ends during the sample period. The remaining sample consists of 388 calendar year firms and 99 firms with years ending in May, June, or July.

To increase the power of the empirical tests to detect tax-related earnings management, two subsets of sample firms are identified that are not expected to respond to tax rate reductions by reducing accounting accruals. These firms are (1) those expected to be subject to the Alternative Minimum Tax (AMT), and (2) those with net operating loss carry-forwards. Each of these two sets of firms is discussed more fully below.

If managers expected a corporation to be subject to the AMT "book income adjustment" in 1987, one way to avoid the tax would be to minimize financial statement income in 1987 by accelerating income out of 1987 and into 1986. Therefore, although the tax rate reduction in the TRA is expected to provide an incentive for corporations to defer taxable income from 1986 to later years, some corporations (those expecting to be subject to the AMT) have an incentive to accelerate financial statement income into 1986.¹⁷ Firms likely to be subject to the alternative minimum tax are identified using two different methods. First, the NAARS data base on the LEXIS/NEXIS system was searched. Although this procedure was successful in identifying those firms that actually paid (and disclosed) the AMT, it did not identify those firms that may have avoided the AMT by accelerating financial statement income from 1987 to 1986. In order to identify these firms, the method developed in Gramlich (1991) and Choi et al. (1991) is used, which is based on the ratio of taxes paid to tax expense (TP/TE). For purposes of this study, those

¹² The mean R^2 in Jones is 0.232. However, the model in Jones also contained a term for property, plant, and equipment as well as an intercept.

¹³ Following the recommendation in Kmenta (1986, 330), an intercept term is added to the model before the Durbin Watson statistics are calculated.

¹⁴ The results of empirical tests were reestimated using parameters from a Cochrane Orcutt type method (Yule-Walker) and assuming an AR(1) process. The results are essentially the same as those reported.

¹⁵ Because of unique tax rules applicable to firms in the extractive industries, financial institutions, and insurance companies, these firms are not expected to respond to tax rate changes in the same manner as other firms. Also, because of regulatory requirements (and perhaps the lack of opportunities), public utilities are not expected to engage in earnings management to the same extent as other firms.

¹⁶ Ideally, only June year-end firms would be included in the second subsample. However, in order to increase the sample size, May and July year-end firms are also included. These firms face a one-year decrease in the tax rate of 11 percent (46 percent to 35 percent for May year-end firms, and 45 percent to 34 percent for July year-end firms).

¹⁷ This incentive to accelerate 1987 income into 1986 to avoid the AMT is studied by Gramlich (1991), Manzon (1992), and Choi et al. (1991).

Table 1
Summary Statistics for Time Series Regressions of Current
Accruals on Changes in Sales for Sample Firms

Model: $CACC_{it}/A_{it-1} = \beta_1 [\Delta SALES_{it}/A_{it-1}] + \varepsilon_i$						
<i>Regression Statistic</i>	<i>Mean</i>	<i>10%</i>	<i>25%</i>	<i>Median</i>	<i>75%</i>	<i>90%</i>
Calendar Year Firms (n=388)						
R Squared	0.381	0.043	0.137	0.376	0.593	0.751
Estimated β_1	0.141	0.016	0.062	0.134	0.212	0.290
Durbin Watson Statistic	2.201	1.540	1.843	2.221	2.565	2.826
Autocorrelation	-0.134	-0.413	-0.319	-0.169	0.028	0.213
May, June, and July Fiscal Year-End Firms (n=99)						
R Squared	0.474	0.071	0.270	0.528	0.704	0.800
Estimated β_1	0.175	0.037	0.093	0.177	0.250	0.320
Durbin Watson Statistic	2.163	1.519	1.706	2.147	2.594	2.903
Autocorrelation	-0.116	-0.450	-0.294	-0.104	0.070	0.207

$CACC_{it}$ = current accruals in year t for firm i ; $\Delta SALES_{it}$ = sales in year t less sales in year $t-1$ for firm i ; A_{it-1} = total assets in year $t-1$ for firm i . The computation of current accruals is from Jones (1991) as follows:

$$CACC_t = [\Delta \text{Current Assets}_t(4) - \Delta \text{Cash}_t(1)] - [\Delta \text{Current Liabilities}_t(5) - \Delta \text{Current Maturities of Long Term Debt}_t(44) - \Delta \text{Income Taxes Payable}_t(71)]$$

where the change (Δ) is computed between time t and time $t-1$. COMPUSTAT data item numbers are given in parentheses.

sample firms in the lowest quartile with respect to TP/TE are considered to be "low TP/TE" firms and are assumed to be those most likely to be affected by the alternative minimum tax.

Firms with net operating loss carry-forwards (NOLCs) from 1986 are not subject to tax at the 46 percent pre-TRA rate, since they have tax losses that cannot be carried back for a refund and must be carried forward until such time as they can be offset against taxable income. Deferring taxable income from 1986 for these firms will simply increase the amount of the NOLC. Firms with tax net operating loss carry-forwards are identified using the NAARS data base for the year 1986. For each firm identified by the search, the income tax footnote in the financial statement was examined to make sure that the firm actually had a net operating loss carry-forward for U.S. income tax purposes for 1986.

III. Results of Empirical Tests

The tests of earnings management presented in this section are based on the prediction errors from the model in equation (6). To compute prediction errors, the parameters of equation (6) are first estimated over the 13-year estimation period 1972 through 1984. The estimated parameters from these regressions are then used to derive expected current accruals for the four-year prediction period, 1985 through 1988. Prediction errors from this model for each prediction year p (u_{ip}) are calculated as follows:

$$u_{ip} = \text{CACC}_{ip} / A_{ip-1} - b_i [\Delta \text{SALES}_{ip} / A_{ip-1}], \quad (7)$$

where b_i is the estimate of β_i . Following Patell (1976), a standardized prediction error (V_{ip}) is derived for each firm i for each prediction period p by dividing the prediction error (u_{ip}) by the estimated standard deviation (σ_{ip}), where σ_{ip} is based on the estimation period residuals from the regression model.¹⁸

The empirical tests take the form of a multiple regression, with the standardized prediction errors from equation (7) as the dependent variable, and with firm size, debt level, and manager ownership as the three independent variables. The regression takes the following form:

$$V_{ip} = \gamma_0 + \gamma_1 \text{SIZE}_{ip} + \gamma_2 \text{DA}_{ip} + \gamma_3 \text{MGT}_{ip}, \quad (8)$$

where SIZE is equal to 1 if the firm's sales for 1986 are in the highest quartile, and 0 otherwise;¹⁹ DA is equal to the book value of long-term debt divided by total assets; and MGT is equal to the percentage of outstanding stock owned by officers and directors. The data for SIZE and DA are from COMPUSTAT, while the data for MGT are from Compact Disclosure. For 1986, the predicted signs of the coefficients are γ_0 , γ_1 and γ_3 negative (H1, H3, and H5), and γ_2 positive (H4).

Table 2 reports the results of this regression for calendar year firms, excluding Alternative Minimum Tax firms ($n=110$) and tax loss firms ($n=56$). The R^2 for 1986 (the year prior to the tax rate reduction) is the largest of the four years presented (0.067), and the F statistic for the regression is only significant in 1986. The intercept of this regression (γ_0) represents the mean standardized prediction error, after controlling for the effect of size (large firms), debt levels, and the percentage of manager ownership. The intercept is negative and significant at the 0.05 level (one-tail test) for 1986, indicating that the sample firms had negative current accruals for that year, consistent with hypothesis H1. However, the intercept is also negative and significant in the 1985 regression, and the magnitudes of the intercept for each year is approximately the same (0.311 for 1985 and 0.376 for 1986). Therefore, the negative intercept for 1986 cannot be attributed to the 1987 tax reductions. The coefficient for size for 1986 (γ_1) is negative and significant, indicating that the mean accruals for large firms are more negative than for other firms, consistent with hypothesis H3. Also, the intercept for large firms ($\gamma_0 + \gamma_1$) is negative and significant.

Table 2 also reports that the coefficient for the debt to asset ratio (γ_2) is positive and significant for 1986. This result suggests that the more leverage a firm has, the more likely it would have positive (i.e., income increasing) or less negative accruals, a result consistent with the prediction in hypothesis H4. Because of the nearness of binding debt covenant constraints, highly leveraged firms may be reluctant to reduce financial statement income to save taxes. Table 2 also reports that the coefficient for the percentage of manager ownership (γ_3) is not significantly different from zero, suggesting that the level of manager ownership of a firm has no relation to the willingness of managers to shift financial statement income to save taxes.²⁰

¹⁸ V_{ip} is computed as $u_{ip} / \left[s_i^2 (I + C_{ip}) \right]^{1/2}$ where $C_{ip} = [X_p (X'X)^{-1} X_p']$ in which X is the matrix of independent variables for the estimation period; X_p is the matrix for the prediction period; and s_i^2 is the mean squared error from the estimation period regression model.

¹⁹ The decision to use a dichotomous rather than a continuous variable for sales is based on empirical results in Scholes et al. (1992), who report finding a significant effect for only large firms.

²⁰ Niehaus (1989) suggests that there may be a nonmonotonic relation between manager ownership and accounting method choice, with one relation at relatively low levels of ownership and a different relation at higher ownership levels. However, the results of estimating equation (8) using both MGT and MGT² are the opposite of those predicted by Niehaus.

Table 2
Multivariate OLS Regression of Standardized Prediction Errors (V_{ip}) on Explanatory Variables for Calendar Year Firms Other Than Tax Loss^a and Alternative Minimum Tax^b Firms (n=243)

$$\text{Model}^{c,d}: V_{ip} = \gamma_0 + \gamma_1 \text{SIZE}_{ip} + \gamma_2 \text{DA}_{ip} + \gamma_3 \text{MGT}_{ip}$$

Coefficient estimates, t-statistics, and p-values (two tailed)

Year	γ_0	γ_1	γ_2	γ_3	$\gamma_0 + \gamma_1$	R^2
1985	-0.311	0.311	1.156	0.005	0.000	0.022
t-statistic (F stat.)	-1.91	1.49	1.65	0.91	0.00	(1.81)
p-value	(0.058)	(0.138)	(0.099)	(0.364)	(0.998)	(0.146)
1986 ^e	-0.376	-0.654	2.591	0.004	-1.029	0.067
t-statistic (F stat.)	-1.76	-2.40	3.19	0.62	-3.86	(5.70)
p-value	(0.080)	(0.017)	(0.002)	(0.539)	(0.000)	(0.001)
1987 ^f	-0.216	-0.004	0.337	0.005	-0.219	0.003
t-statistic (F stat.)	-1.05	-0.01	0.46	0.62	-0.83	(0.22)
p-value	(0.295)	(0.990)	(0.644)	(0.538)	(0.405)	(0.882)
1988 ^g	0.035	-0.363	0.387	-0.001	-0.328	0.008
t-statistic (F stat.)	0.17	-1.28	0.61	-0.17	-1.22	(0.66)
p-value	(0.865)	(0.201)	(0.540)	(0.869)	(0.225)	(0.578)

^a Tax loss firms are those with a U.S. federal tax loss carry-forward in 1986, identified using NAARS.

^b Alternative minimum tax firms are firms that were subject to the alternative minimum tax in 1987, identified using NAARS, as well as firms with a ratio of average taxes paid to average tax expense (TP/TE) of less than 0.784 (the lowest quartile). Averages are for the three years prior to 1986. The use of the ratio TP/TE is based on Choi et al. (1991).

^c Following Patell (1976), V_{ip} is computed as

$$u_{ip} / \left[s_i^2 (I + C_{ip}) \right]^{1/2} \text{ where } C_{ip} = \left[X_p (X'X)^{-1} X_p' \right]$$

in which X is the matrix of independent variables for the estimation period, X_p is the matrix for the prediction period, u_{ip} is the prediction error, p is the prediction year, and s_i^2 is the mean squared error from estimates of the following regression model:

$$\text{CACC}_{it} / A_{it-1} = \beta_1 [\Delta \text{SALES}_{it} / A_{it-1}] + \varepsilon_{it},$$

where CACC_{it} = current accruals in year t for firm i ; ΔSALES_{it} = sales in year t less sales in year $t-1$ for firm i ; A_{it-1} = total assets in year $t-1$ for firm i ; ε_{it} = error term in year t for firm i . The computation of current accruals is from Jones (1991) as follows:

$$\begin{aligned} \text{CACC}_t = & [\Delta \text{Current Assets}_t(4) - \Delta \text{Cash}_t(1)] - [\Delta \text{Current Liabilities}_t(5) \\ & - \Delta \text{Current Maturities of Long Term Debt}_t(44) - \Delta \text{Income Taxes Payable}_t(71)] \end{aligned}$$

where the change (Δ) is computed between time t and time $t-1$. COMPUSTAT data item numbers are given in parentheses.

^d $\text{SIZE} = 1$ if sales are in the highest quartile for 1986, and 0 otherwise; DA = long term debt/total assets; MGT = percentage of outstanding shares owned by officers and directors. All data are from COMPUSTAT except for MGT , which is from Compact Disclosure.

^e Last year at the old 46% tax rate.

^f Transition year; tax rate 40%.

^g First year at the new 34% tax rate.

Table 3

Multivariate OLS Regression of Standardized Prediction Errors (V_{ip}) on Explanatory Variables for May, June, and July Fiscal Year Firms Other Than Tax Loss^a and Alternative Minimum Tax^b Firms (n=67)

Model ^{c,d} : $V_{ip} = \gamma_0 + \gamma_1 \text{SIZE}_{ip} + \gamma_2 \text{DA}_{ip} + \gamma_3 \text{MGT}_{ip}$						
<i>Coefficient estimates, t-statistics, and p-values (two tailed)</i>						
<i>Year</i>	γ_0	γ_1	γ_2	γ_3	$\gamma_0 + \gamma_1$	R^2
June 1986	0.175	-0.245	0.358	-0.012	-0.071	0.059
t-statistic (F stat.)	0.56	-0.62	0.29	-1.91	-0.17	(1.37)
p-value	(0.579)	(0.539)	(0.770)	(0.061)	(0.862)	(0.261)
June 1987 ^e	-0.222	-0.623	4.157	-0.003	-0.844	0.170
t-statistic (F stat.)	-0.59	-1.24	3.23	-0.34	-1.75	(4.43)
p-value	(0.559)	(0.221)	(0.002)	(0.735)	(0.085)	(0.007)
June 1988 ^f	0.126	0.382	-0.944	0.002	0.508	0.053
t-statistic (F stat.)	0.58	1.28	-1.24	0.45	1.78	(1.21)
p-value	(0.564)	(0.204)	(0.218)	(0.652)	(0.080)	(0.315)

^a Tax loss firms are those with a U.S. federal tax loss carry-forward in 6/87, identified using NAARS.

^b Alternative minimum tax firms are firms that were subject to the alternative minimum tax in 6/87, identified using NAARS, as well as firms with a ratio of average taxes paid to average tax expense (TP/TE) of less than 0.768 (the lowest quartile). Averages are for the three years prior to 6/87. The use of the ratio TP/TE is based on Choi et al. (1991).

^c Following Patell (1976), V_{ip} is computed as

$$u_{ip} / \left[s_i^2 (I + C_{ip}) \right]^{1/2} \text{ where } C_{ip} = \left[X_p (X'X)^{-1} X_p' \right]$$

in which X is the matrix of independent variables for the estimation period, X_p is the matrix for the prediction period, u_{ip} is the prediction error, p is the prediction year, and s_i^2 is the mean squared error from estimates of the following regression model:

$$\text{CACC}_{it} / A_{it-1} = \beta_1 [\Delta \text{SALES}_{it} / A_{it-1}] + \varepsilon_{it},$$

where CACC_{it} = current accruals in year t for firm i ; ΔSALES_{it} = sales in year t less sales in year $t-1$ for firm i ; A_{it-1} = total assets in year $t-1$ for firm i ; ε_{it} = error term in year t for firm i . The computation of current accruals is from Jones (1991) as follows:

$$\begin{aligned} \text{CACC}_t = & [\Delta \text{Current Assets}_t(4) - \Delta \text{Cash}_t(1)] - [\Delta \text{Current Liabilities}_t(5) \\ & - \Delta \text{Current Maturities of Long Term Debt}_t(44) - \Delta \text{Income Taxes Payable}_t(71)] \end{aligned}$$

where the change (Δ) is computed between time t and time $t-1$. COMPUSTAT data item numbers are given in parentheses.

^d $\text{SIZE} = 1$ if sales are in the highest quartile for the year 6/87, and 0 otherwise; DA = long term debt/total assets; MGT = percentage of outstanding shares owned by officers and directors. All data are from COMPUSTAT except for MGT , which is from Compact Disclosure.

^e Last year at the old 46% tax rate.

^f First year at the new 34% tax rate.

Table 3 reports the results of estimating equation (8) for firms with May, June, and July year-ends, excluding Alternative Minimum Tax firms ($n=25$) and tax loss firms ($n=8$). The R^2 for June 1987 (the year prior to the tax rate reduction) is the largest of the three years presented (0.170), and the F statistic for the regression is only significant in June 1987. The intercept of this regression (γ_0) for June 1987 is negative but not significantly different from zero, although the intercepts in the other two years are positive. The coefficient on SIZE for June 1987 (γ_1) is also negative and not significant. However, the intercept for large firms ($\gamma_0 + \gamma_1$) is negative and significant at the 0.05 level (one tail test), a result consistent with the prediction of hypothesis H1.

Table 3 also shows that the coefficient on the debt to asset ratio (γ_2) is positive and significant for June 1987. This result, which is only present in June 1987, is consistent with the prediction in hypothesis H4. The coefficient for the percentage of manager ownership (γ_3) is not significantly different from zero.

One final test is conducted in order to directly test the prediction of hypothesis H2, that firms with June year-ends are more likely to have negative current accruals in the year prior to the tax rate reductions. In this test, observations for calendar year firms for 1986 and May, June, and July firms for June 1987 are combined into one sample in order to estimate equation (8). Before estimating this model, an additional explanatory variable was added (JUNE) equal to 1 if the sample firm had a year-end of May, June, or July, and equal to 0 if the sample firm had a calendar year-end. To be consistent with the prediction of hypothesis H2, the coefficient on JUNE is expected to be negative. The results of estimating this model (not reported) find that the coefficient on JUNE is positive, which is not consistent with the prediction of hypothesis H2. Based on these results, there is no evidence that firms with May, June, or July year-ends made larger income reducing accruals than calendar year firms in anticipation of the tax rate reductions.

Sensitivity Tests

Two sets of additional robustness tests were carried out. First, equation (8) was reestimated for the calendar year firms for 1986 after adding 22 additional explanatory variables (IND_{ki} , $k=1...22$), where $IND_{ki} = 1$ if firm i is in industry k , and 0 otherwise. The industry classification used was based on two-digit SIC codes, obtained from COMPUSTAT. The second test was designed to control for situations in which economic factors other than tax rate reductions may have caused firms to have negative current accruals in 1986. One such possibility is the disposition of a major segment of a firm's operations during the year. The empirical tests for the calendar year firms were repeated for 1986 after eliminating those firms reporting income or loss from discontinued operations for 1986 ($n=34$ firms). The results from repeating both of these tests are essentially the same as those reported. Based on this result, the results reported in this study do not appear to be sensitive to industry effects or to a major economic event such as the disposal of a segment.

IV. Conclusion

This study investigates whether accounting earnings of U.S. corporations are managed in response to changes in the statutory corporate income tax rate brought about by the Tax Reform Act of 1986. Evidence of earnings management is examined by focusing on accounting accruals. Total accruals are separated into those types of accruals that are not expected to have a significant effect on taxable income (called "non-current accruals," e.g., depreciation) and those types of accruals that are expected to affect taxable income (called "current accruals," e.g., accounts receivable, accrued payables).

The study develops a hypothesis that predicts income decreasing (i.e., negative) accruals in the year prior to the tax rate reductions. Further hypotheses predict that these income decreasing accruals will be greater for firms with June year-ends, large firms, firms with low debt levels, and firms with a high level of manager ownership. Using an accruals expectation model, standardized prediction errors for current accruals are developed using time series regression models for each sample firm. The results of empirical tests report significantly negative current accruals for large firms for the year prior to the tax rate reduction. Current accruals are also positively related to debt levels but are not related to manager ownership.

References

- Cahan, S. F. 1992. The effect of antitrust investigations on discretionary accruals: A refined test of the political-cost hypothesis. *The Accounting Review* 67 (January): 77-95.
- Choi, W. W., J. D. Gramlich, and J. K. Thomas. 1991. Earnings management in response to the book income adjustment of the corporate alternative minimum tax. Working Paper, Columbia University.
- DeAngelo, L. 1986. Accounting numbers as market valuation substitutes: A study of management buyouts of public stockholders. *The Accounting Review* 61 (July): 400-20.
- Gramlich, J. 1991. The effect of the alternative minimum tax book income adjustment on accrual decisions. *Journal of the American Taxation Association* 13 (Spring): 36-56.
- Healy, P. 1985. The effect of bonus schemes on accounting decisions. *Journal of Accounting and Economics* 7 (April): 85-107.
- Hunt, H. 1985. Potential determinants of corporate inventory accounting decisions. *Journal of Accounting Research* 23 (Autumn): 448-67.
- Jones, J. 1991. Earnings management during import relief investigations. *Journal of Accounting Research* 29 (Autumn): 193-228.
- Kmenta, J. 1986. *Elements of Econometrics*. 2d ed. New York: Macmillan.
- Liberty, S. E., and J. L. Zimmerman. 1986. Labor union contract negotiations and accounting choices. *The Accounting Review* 61 (October): 692-712.
- Manzon, G. 1992. Earnings management of firms subject to the alternative minimum tax. *Journal of the American Taxation Association* 14 (Fall): 86-111.
- McNichols, M., and G. P. Wilson. 1988. Evidence of earnings management from the provision for bad debts. *Journal of Accounting Research* 26 (Supplement): 1-31.
- Niehaus, G. 1989. Ownership structure and inventory method choice. *The Accounting Review* 64 (April): 269-84.
- Patell, J. M. 1976. Corporate forecasts of earnings per share and stock price behavior: Empirical tests. *Journal of Accounting Research* 14 (Autumn): 246-76.
- Scholes, M. S., G. P. Wilson, and M. A. Wolfson. 1992. Firms' responses to anticipated reductions in tax rates: The Tax Reform Act of 1986. *Journal of Accounting Research* 30 (Supplement): 161-85.
- _____, and M. A. Wolfson. 1986. Taxes and organization theory. Paper presented at the Yale Conference on Economics of Organization.
- _____, and _____. 1989. Issues in the theory of optimal capital structure. In *Frontiers of Modern Financial Theory*, edited by S. Bhattacharya and G. Constantinides, 49-74. Totowa, NJ: Rowman & Littlefield.
- Watts, R. L., and J. L. Zimmerman. 1978. Towards a positive theory of the determination of accounting standards. *The Accounting Review* 53 (January): 112-34.
- _____, and _____. 1986. *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice Hall.
- Wilkie, P. 1988. Corporate average effective tax rates and inferences about relative tax preferences. *Journal of the American Taxation Association* 10 (Fall): 75-88.

A Simultaneous Equations Analysis of Quality Control Review Outcomes and Engagement Fees for Audits of Recipients of Federal Financial Assistance

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SYNOPSIS AND INTRODUCTION: Often overlooked in empirical analyses of the relation between audit quality and audit fees is the recognition that they are mutually determined by the interaction of the client's demand for, and the audit firm's supply of, audit quality. Failure to account for this endogeneity can lead to biased inferences concerning the audit quality/audit fee relation.

We adopt a simultaneous equations estimation procedure (offered by Amemiya 1978) applicable to jointly determined endogenous variables when one of the variables (in our case the quality review outcome) is qualitative in nature.¹ To illustrate the procedure, we use a dataset developed by the United States General Accounting Office (GAO 1987) in its study of the audit procurement practices of entities receiving federal financial assistance. Inferences using this procedure differ from those of single-stage analyses. The results suggest that within the context of the application examined, audit fees appear to be positively related to the supply of audit quality and inversely related to the demand for audit quality.

¹ To date, most audit quality measures used in empirical studies have been of a qualitative nature (Palmrose 1984; Simunic and Stein 1987; Feltham et al. 1991; Gaver et al. 1992; and Copley and Doucet 1993). See Maddala (1983) for a discussion of the use of limited dependent variables and their latent constructs in econometrics.

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These findings have implication for studies involving audit fees and studies examining the demand characteristics of auditing.

Key Words: *Audit quality, Audit fees, Simultaneous equations model, Supply of audit quality, Demand for audit quality.*

Data Availability: *The data used in this study are available from the authors upon request.*

THE remainder of this article is organized as follows: section I discusses the background and motivation for the study and provides a brief overview of the salient literature. Section II provides the model specification and describes the data used in the study. Section III reviews the statistical methodology and section IV presents results. The final section summarizes the study and discusses the implications of this research.

I. Background and Motivation

The Cohen Commission (AICPA 1978) found that the most significant cause of substandard audits is time pressure generated by low audit fees and arbitrary deadlines.² A decade later, the Treadway Commission (1987) made a similar observation:

Intense competition among accounting firms contributes to significant pressures on audit fees, often with corresponding pressure to reduce staff, time budgets, and partner involvement in audit engagements. (56)

Both commissions suggested that low audit fees are a significant factor contributing to poor audit quality.

In academic research most prior studies of audit quality (e.g., Palmrose 1984) and audit fees (e.g., Simunic 1980) consider fees and quality independently. Since audit fees and audit quality are jointly determined endogenous variables, ignoring this relation leads to problems of parameter identification and estimation biases.³ In their overview of the auditing environment, Chow et al. (1988) argue that "the complexity of an entity's transactions affects both its demand for auditing services and the costs of supplying such services. This . . . would indicate the existence of a simultaneous equations problem when analyzing the amount of auditing services transacted" (174).

Audit Fee Studies

Since Elliott and Korpi (1978) and Simunic (1980) reported the results of their surveys, audit fees have been the subject of numerous investigations. These investigations generally represent fees as a function of various client characteristics intended to proxy for differences in the marginal costs of performing the audit. Fee premiums associated with individual firms (Simunic 1980) and groups of firms (e.g., Francis 1984; Palmrose 1986; Francis and Simon 1987) are interpreted as indirect evidence of the fee effect of quality differentiated audit services (Simunic 1980; Palmrose 1986).⁴

² The Commission reports that "56 percent of those in the profession and 65 percent of those who have left the profession believe that audit programs and time budgets are unduly influenced by client negotiated fees" (116).

³ Economists have long recognized that when investigating markets for commodities, the simultaneous determination of prices and quantities must be considered.

⁴ This interpretation is supported by analytical work by Klein and Leffler (1981) who demonstrate that a price premium is necessary to assure the production of higher quality goods and services.

Based on this argument, Beatty (1989) finds an inverse relation between auditor reputation and residual return on initial public offerings. The appropriateness of using the unexplained component of audit fee as a proxy for reputation and quality rests upon the untested assumption that fee differences reflect differential audit quality. Alternative scenarios exist, however. For example, Beck and Barefield (1986) demonstrate that audit fees are determined, at least in part, by the cost structures of audit firms and argue that variability among audit bids is not necessarily indicative of differences in audit quality. However, the ability to distinguish between cost and quality differentiation as an explanation of fee differences requires direct tests of the relation between audit quality supplied and audit fees.

Audit Demand Studies

Various researchers (e.g., Watts and Zimmerman 1983) argue that the demand for auditing services arises from conflict of interest between managers, creditors, and outside shareholders. Early empirical studies examine the relation between size, debt, and political or ownership factors and the decision to hire an outside audit (Chow 1982; Wallace 1986). The results suggest that the demand for audit assurance arises from the desire to monitor the actions of agents. Given that the nature and extent of agency conflicts vary across entities, it follows that the desired level of audit assurance will also vary.

Based on this argument, several investigators examine factors associated with the choice of a Big Eight (now Big Six) audit firm. For example, Palmrose (1984) investigates the relation between *agency-cost* variables (ownership, leverage, size, and compensation) and the choice of a Big Eight auditor for a sample of public companies across several industries. Client size, a proxy for the number and complexity of agency relationships, is a consistently significant explanatory variable in the analysis comparing Big Eight and others. Simunic and Stein (1987) perform a similar study for a sample of initial public offerings. Although their results are consistent with agency-cost scenario, they obtain the puzzling finding that higher risk firms tend to choose less prestigious auditors. They ascribe this anomaly to intervening factors, such as the inability to control for the effect of audit fees.⁵

The concept of differing demand for audit quality is also discussed in studies dealing with new issues (Bachar 1989; Datar et al. 1991). Feltham et al. (1991) examine the relation between audit quality and firm risk using a Big Eight/non-Big Eight proxy for audit quality. They show weak evidence suggesting that firms with higher firm-specific risk choose higher quality auditors. They attribute the lack of strong statistical significance to the inability to control for *supply-side* effects (i.e., the incremental cost of hiring a high quality auditor increasing significantly with firm risk) and suggest considering joint analysis of both demand and supply effects.

In summary, the extant literature shows that audit fees have not been directly incorporated into empirical analyses of audit demand.⁶ Failure to explicitly consider the fee effect of an entity's transactions or operating characteristics in audit demand models can obscure empirical relations or produce results that are inconsistent with theory.

II. Model Specification and Sample Description

Unlike homogeneous commodities (e.g., wheat), an audit is a multiattribute good, with the auditor's reputation or brand name being one differentiating attribute (DeAngelo 1981; Simunic

⁵ Specifically, increased uncertainty associated with the client's securities (i.e. business risk) causes auditors to increase their audit fees. This increase in turn motivates management to demand an overall lower level of credibility and reduces the likelihood of selecting a Big Eight auditor.

⁶ Deis and Giroux (1992) recognize the joint endogeneity of audit quality and audit fees, but rely on Hausman's specification test to establish that simultaneous-equations bias is not present in their application.

and Stein 1987). A second dimension on which an audit is differentiated is the industry and regulatory expertise of the auditor. Finally, Wallace (1980) observes that clients desiring greater levels of audit assurance may contract for extended tests.

Another characteristic of audit services is that audit outcomes are uncertain. Every auditor possesses some probability of providing an audit that would ultimately be revealed as substandard. Such probabilities vary across audit firms. *Ceteris paribus*, clients with higher audit quality demands can reduce the risk of substandard audits by selecting auditors offering higher average quality.⁷ However, higher levels of effort, expertise, and reputation capital are costly to provide. Simunic (1980) notes that the audit market is a hedonic market, where differences in product characteristics are associated with differences in fees. The result is that for a given audit, the audit fee varies across different audit firms, each of which provides a different combination of service characteristics. It follows that audit fee and quality are simultaneously determined through the selection of an auditor.

A conceptual model embodying these ideas is given in equations (1.1) and (1.2).

$$\text{Quality} = f \left[\begin{array}{c} \text{client demand} \\ \text{characteristics} \end{array}, \text{fee} \right] \quad (1.1)$$

$$\text{Fee} = f \left[\begin{array}{c} \text{client} \\ \text{complexity} \end{array}, \text{competition, factors related} \right. \\ \left. \text{to the audit bid}, \text{quality} \right] \quad (1.2)$$

Audit quality appears as an explanatory variable in the fee model and fee appears as an explanatory variable in the quality model, making explicit the joint endogeneity of fee and quality. To demonstrate the simultaneous equations procedure, we specify the structural form of the model in equations 2.1 and 2.2. The model is specific to the population of recipients of federal financial assistance and is underspecified in that it does not incorporate all known demand characteristics and audit fee determinants. Nevertheless, the variables available from existing data have support from previous audit demand/fee studies.⁸

We specify the structural form of the model as:

$$\text{QUALINDX} = \alpha_0 + \alpha_1 \text{LN(SIZE)} + \alpha_2 \text{FINOFFCL} + \alpha_3 \text{GOVT} + \alpha_4 \text{LN(FEE)} + u_1 \quad (2.1)$$

$$\text{LN(FEE)} = \beta_0 + \beta_1 \text{LN(SIZE)} + \beta_2 \text{LN(\# BIDS)} + \beta_3 \text{COSTWGHT} + \beta_4 \text{TENURE} \\ + \beta_5 \text{QUALINDX} + u_2 \quad (2.2)$$

⁷ We do not suggest that entities receiving audits that do not comply with professional standards knowingly contract for substandard audits. Nevertheless, it is reasonable to think that clients can differ in their aversions to this risk.

⁸ Palmrose (1984) and Simunic and Stein (1987) argue that the demand for audit quality is positively related to client size. The GAO (1987) finds that the likelihood of receiving an acceptable quality audit is significantly higher when a financial official (e.g., controller or treasurer) is involved in the auditor selection process (see also Evans and Patton 1983 for a discussion of signaling incentives and choice of auditor). Copley and Doucet (1993) find that state and local governments exhibit a higher demand for audit quality than other recipients of federal financial assistance.

Client size, which proxies for client complexity, is the largest and most consistently significant audit fee determinant across client populations (e.g. Palmrose 1986; Francis and Simon 1987; Rubin 1988). The Anderson Committee (AICPA 1986) and Treadway Commission (1987) suggest that competition (reflected here by the number of bids received), together with client sensitivity to audit fees (COSTWGHT), create pressures to minimize audit fees. Finally, Rubin (1988) finds governmental audit fees to be associated with auditor tenure.

where QUALINDX is a latent variable defining the quality of the audit; SIZE is the budgeted total revenues of the client;⁹ FINOFFCL indicates whether a finance official represented the client's interests during the auditor selection (FINOFFCL = 1 if finance official present; 0 if absent); GOVT indicates whether the client is a city, county, or state government (GOVT = 1 if client is a government; 0 if not); FEE is the audit fee charged by the auditor for the engagement; #BIDS is the number of audit firms that bid for the engagement; COSTWGHT is an equally spaced, five point measure indicating (in the judgment of client personnel) how much weight, relative to all other criteria, is given to cost by the entity in selecting an auditor (COSTWGHT = 0.0 if no weight given to cost; COSTWGHT = 1.0 if cost is the only criterion used); and TENURE is a five category ordinal variable indicating the number of previous audits performed by the current auditor.¹⁰

The data were collected by the U.S. General Accounting Office (GAO 1987) for a study of the relation between audit procurement practices and audit quality. Audit quality is evaluated by Offices of Regional Inspectors General (RIGs) and includes a review of audit working papers as well as audit reports. An audit is deemed unacceptable if the CPA does not perform or document the required fieldwork in any segment of the audit or if the CPA fails to report material internal control weaknesses or noncompliance with laws and regulations governing the use of federal funds.¹¹ Even though QUALINDX is unobserved, we assume that it is linked to the quality review outcome QUALDUM, indicating whether the audit is judged acceptable by the reviewing RIG. Specifically, we assume that QUALDUM = 1 whenever QUALINDX > 0 (i.e., QUALINDX is observed only with respect to sign).¹²

Additional information concerning the audit and audit procurement practices was obtained through a questionnaire prepared and mailed by the GAO. We obtained the audit quality assessments and completed questionnaires for 165 entities.¹³ Data on the level of audit fees or some of the explanatory variables were not available for 47 of the sample entities, reducing our usable sample to 118. Descriptive statistics for these entities are summarized in table 1 and bivariate correlation coefficients appear in table 2.

⁹ In the case of housing authorities and certain educational institutions, the level of federal funds subject to audit was deemed to provide a more appropriate measure of auditee size. These entities receive funds that are distributed to program participants in the form of grants or loans. The funds are subject to audit but are not included in the institution's revenues. In many cases, the federal funds subject to audit were many times larger than the entity's revenues. Model results were not sensitive to the specific size measure employed.

¹⁰ TENURE categories include 0, 1, 2 to 5, 6 to 10, and more than 10. Midpoints (3.5 and 8) are used for the two categories representing ranges of values. The minimum value (11) is used for the highest category.

¹¹ We discussed the nature of the unacceptable quality assessments with a representative of the GAO. It is the view of the GAO that in all cases these assessments represented substantive instances of noncompliance with professional standards. As evidence of this, all auditors providing unacceptable quality were referred to the ethics committees of either the AICPA or the state boards of accountancy for investigation and possible disciplinary action.

¹² At the conceptual level, audit quality is defined in terms of audit assurance (i.e., the probability that material errors in the financial report will be both identified and reported by the auditor, DeAngelo 1981). Admittedly, ex post measures of auditor compliance with professional standards provide imperfect measures of ex ante audit quality. However, if a positive relation exists between the level of audit assurance and the propensity to be in compliance with professional standards, then audit firms specializing in lower quality levels will exhibit higher frequencies of non-compliance with professional standards than firms specializing in higher quality levels. We argue that ex post measures of compliance are sufficiently correlated with audit quality to allow identification of ex ante relations.

¹³ See GAO (1987) for additional description of the survey instrument and sample selection. The GAO reports a response rate of 70 percent on this questionnaire. The identities of the survey respondents were removed from the survey instruments. Auditor identities did not appear on the surveys or on the audit quality assessments.

Table 1

Descriptive Statistics Classified by Audit Quality of Selected Variables Pertaining to a Sample of 118 Audit Reports Drawn from a Population of Audited Federal Assistance Programs and Reviewed by the U.S. General Accounting Office in 1985

<i>Audit Quality Acceptable (n=74)^a</i>						
<i>Variable</i>	<i>Mean</i>	<i>Minimum</i>	<i>First Quartile</i>	<i>Median</i>	<i>Third Quartile</i>	<i>Maximum</i>
SIZE(\$M) ^b	516.16 ⁱ	0.03	0.63	9.18	140.50	13,700.00
FEE(\$Th) ^c	65.10 ⁱ	0.30	5.50	17.75	60.39	806.79
#BIDS ^d	4.42 ⁱ	1	2	4	7	13
FINOFFCL ^e	0.85 ^j	0	1	1	1	1
GOVT ^f	0.28 ^j	0	0	0	1	1
COSTWGHT ^g	0.54	0.00	0.25	0.50	0.75	1.00
TENURE ^h	2.92	0	0	1.0	3.5	11.0
<i>Audit Quality Unacceptable (n=44)^a</i>						
<i>Variable</i>	<i>Mean</i>	<i>Minimum</i>	<i>First Quartile</i>	<i>Median</i>	<i>Third Quartile</i>	<i>Maximum</i>
SIZE(\$M) ^b	14.20 ⁱ	0.05	0.46	1.34	9.94	180.10
FEE(\$Th) ^c	16.93 ⁱ	0.44	2.48	6.65	20.12	178.50
#BIDS ^d	3.25 ⁱ	1	1	2	3.75	17
FINOFFCL ^e	0.68 ^j	0	0	1	1	1
GOVT ^f	0.05 ^j	0	0	0	0	1
COSTWGHT ^g	0.52	0.00	0.25	0.50	0.75	1.00
TENURE ^h	3.59	0	0	3.5	3.5	11.0
<i>Overall (n=118)</i>						
<i>Variable</i>	<i>Mean</i>	<i>Minimum</i>	<i>First Quartile</i>	<i>Median</i>	<i>Third Quartile</i>	<i>Maximum</i>
SIZE(\$M) ^b	356.14	0.03	0.61	4.46	39.70	13,700.00
FEE(\$Th) ^c	47.14	0.30	3.83	10.87	36.00	806.79
#BIDS ^d	3.98	1	1	3	6	17
FINOFFCL ^e	0.79	0	1	1	1	1
GOVT ^f	0.19	0	0	0	0	1
COSTWGHT ^g	0.53	0.00	0.25	0.50	0.75	1.00
TENURE ^h	3.17	0	0	3.5	3.5	11.0

^aAn audit is deemed to be of unacceptable quality if the CPA: (1) failed to perform or document all required fieldwork, or (2) failed to report material internal control weaknesses or violations of laws and regulations governing the use of federal funds. Audit reports and working papers were evaluated by Offices of Regional Inspectors General.

^bSize of client measured by total budgeted revenues, or for housing authorities and certain education institutions, the level of federal funds subject to audit.

^cThe fee charged by the auditor for the audit engagement.

Table 1 (Continued)

- ^dThe number of auditing firms that bid for the audit engagement with the client.
- ^eA qualitative variable indicating whether or not a financial official of the client (e.g., controller, treasurer, etc.) represented the client's interests in procuring the audit. Financial official present = 1; official absent = 0.
- ^fA qualitative variable indicating whether the auditee is a city, county, or state government. Auditee is a government = 1; auditee is not a government = 0.
- ^gA five-point, equally spaced variable ranging between 0 and 1 indicating, relative to all other criteria, the emphasis placed by the client on cost in selecting an auditor.
- ^hA five category ordinal level variable ranging from 0 to 11 indicating the number of previous audits performed by the auditor.
- ⁱA two-sample t-test of the difference in the average *logarithms* of this variable (not shown in the table) between the acceptable and unacceptable audit quality subsamples is significant at the 0.05 level. A Wilcoxon two-sample test of the untransformed variable is also significant at the 0.05 level.
- ^jA chi-square test of the difference in proportions between the acceptable and unacceptable audit quality subsamples is significant at the 0.05 level.

III. Simultaneous Estimation Procedure

LN(FEE) and QUALINDX are jointly determined endogenous variables. Thus, ordinary least squares (OLS) is inappropriate for estimating equations (2.1) and (2.2) because LN(FEE) and QUALINDX are correlated with u_1 and u_2 , which violates the standard assumptions of the linear model and leads to inconsistent parameter estimates. To avoid these biases, two-stage procedures (see Heckman 1978; Maddala 1983, 242-45) are frequently adopted. We use indirect (generalized) least squares (Amemiya 1978) to obtain consistent parameter estimates for the structural equations. Amemiya shows that this approach is more efficient than two-stage methods.

To implement this procedure, we specify the reduced form equations:

$$\text{QUALINDX} = a_0 + a_1 \text{LN(SIZE)} + a_2 \text{FINOFFCL} + a_3 \text{GOVT} + a_4 \text{LN(\#BIDS)} + a_5 \text{COSTWGHT} + a_6 \text{TENURE} + v_1 \quad (3.1)$$

$$\text{LN(FEE)} = b_0 + b_1 \text{LN(SIZE)} + b_2 \text{FINOFFCL} + b_3 \text{GOVT} + b_4 \text{LN(\#BIDS)} + b_5 \text{COSTWGHT} + b_6 \text{TENURE} + v_2 \quad (3.2)$$

where the disturbance terms v_1 and v_2 are independently and identically distributed normal random variables with zero means, covariance σ_{12} , and variances 1.0 and σ_2^2 , respectively.¹⁴ To estimate $a = (a_0, \dots, a_6)'$, probit analysis is used in equation (3.1) with QUALDUM serving as a surrogate for QUALINDX. The parameters $b = (b_0, \dots, b_6)'$ in equation (3.2) are estimated using ordinary least squares.

Since the structural equations are overidentified (i.e., the number of excluded exogenous variables exceeds the number of endogenous predictors in each equation), Amemiya's method is used to obtain estimates of the structural parameters. Let the structural parameters for the demand equation be written $\alpha = (\alpha_0, \dots, \alpha_4)'$, $\beta = (\beta_0, \dots, \beta_5)'$ for supply, and let the exogenous predictors in the system be written

$$x = [1, \text{LN(SIZE)}, \text{FINOFFCL}, \text{GOVT}, \text{LN(\#BIDS)}, \text{COSTWGHT}, \text{TENURE}].$$

¹⁴ The normalization $\text{Var}(v_1) = 1.0$ is a standard assumption in probit analysis.

Table 2

Spearman Correlations among Variables Pertaining to a Sample of 118 Audit Reports Drawn from a Population of Audited Federal Assistance Programs and Reviewed by the U.S. General Accounting Office in 1985

<i>Variable</i>	QUAL- DUM	SIZE	FEE	#BIDS	FIN- OFFCL	GOVT	COST- WGHT	NEW- CLNT
QUALDUM ^a	1.00							
SIZE	0.24	1.00						
FEE	0.25	0.84	1.00					
#BIDS	0.26	0.48	0.36	1.00				
FINOFFCL	0.20	0.42	0.39	0.18	1.00			
GOVT	0.29	0.46	0.50	0.27	0.15	1.00		
COSTWGHT	0.03	-0.25	-0.33	0.04	-0.07	-0.12	1.00	
TENURE	0.09	0.07	0.19	-0.27	0.12	0.10	0.05	1.00

All correlations with absolute values greater than 0.18 (0.24) are significantly different from zero at the 0.05 (0.01) level.

^aQUALDUM = 0 if the CPA: (1) failed to perform or document all required fieldwork, or (2) failed to report material internal control weaknesses or violations of laws and regulations governing the use of federal funds; otherwise, QUALDUM = 1. Audit reports and working papers were evaluated by Offices of Regional Inspectors General. See table 1 for a description of all other variables.

Amemiya shows that the system's parameters satisfy

$$a = (S_1, b) \alpha \quad (4.1)$$

and

$$b = (S_2, a) \beta \quad (4.2)$$

where S_1 and S_2 are matrices of zeroes and ones such that

$$X S_1 = [1, \text{LN}(\text{SIZE}), \text{FINOFFCL}, \text{GOVT}], \quad (\text{exog. demand predictors})$$

and

$$X S_2 = [1, \text{LN}(\text{SIZE}), \text{LN}(\text{\#BIDS}), \text{COSTWGHT}, \text{TENURE}]. \quad (\text{exog. supply predictors})$$

When a and b are replaced by their reduced form estimates, the structural parameters α and β can be estimated by applying generalized least squares to equations (4.1) and (4.2). Further details, along with the estimators' asymptotic variances and covariances, are found in Amemiya (1978).

IV. Empirical Results

Audit Quality Model

Table 3 presents the results of the indirect generalized least squares procedure for the audit quality model in equation (2.1). For comparison purposes, we also present (in panel B) a single equation probit analysis of the same model, that ignores the endogenous nature of the fee variable on the right-hand side of the equation.

In all cases the signs of the two-stage parameter estimates (simultaneous equations model) are consistent with expectations.¹⁵ Estimates of the standard errors (using the expressions for asymptotic standard errors described by Amemiya (1978) are also presented in table 3, together with the related test statistics and associated probabilities (two-tail values). Of particular interest here is the negative coefficient associated with the audit fee variable. The results indicate that the level of quality demanded decreases with increases in fee. This is consistent with an hypothesized downward sloping demand curve for audit quality.

It is useful to compare the results of the two-stage estimation procedure (panel A) with those of single-stage probit (panel B). Some differences exist in the sign and significance of the individual variables with the single stage probit showing a positive coefficient with the fee variable, a result contrary to expectation.

Audit Fee Model

Table 4 presents a comparison of the results of the fee model (structural equation 2.2), using both a two-stage simultaneous equations estimation procedure (panel A) and single-stage ordinary least squares (OLS) for comparison purposes. In panel A, we observe that in all cases the signs of the estimated parameters obtained from the indirect generalized least squares procedure are consistent with expectations.¹⁶ The variable of primary interest is QUALINDEX. The positive coefficient associated with QUALINDEX indicates that differences in quality are reflected in audit fees. This result is important since differences have been observed in the pricing of audit services by individual firms and by groups of firms.

It is useful to compare the results of the two-stage estimation procedure (panel A) with those of single-stage OLS (panel B). Differences exist in the significance of the individual variables with OLS showing insignificant results for the quality variable.

V. Discussion

We demonstrate how the supply and demand for audit quality can be specified in a simultaneous equations framework. We then empirically examine the relations between audit quality and audit fees using an indirect generalized least squares procedure. The results for the audit fee model indicate a premium associated with higher levels of audit quality, where quality is represented by compliance with professional standards for reporting and fieldwork. This positive relation provides indirect support for the interpretation of significant audit firm effects in earlier studies as representing the fee effect of quality differentiated services. The results also provide some empirical support for the use of quality surrogates derived from audit fee models (e.g., Beatty 1989; Copley 1991).

¹⁵ Regression diagnostics (Belsley et al. 1980) obtained for the reduced form equations suggest that the results are not affected by influential observations or linear dependencies among the variables.

¹⁶ Again, we compute estimates of the standard errors using the procedure described by Amemiya (1978).

Table 3

Comparison of Simultaneous Equations vs Single Equation Parameter Estimates of the Demand Function for Audit Quality Based upon the Dichotomous Variable QUALDUM Indicating Acceptability of 118 Audit Reports Drawn from a Population of Audited Federal Assistance Programs by the U.S. General Accounting Office in 1985

Panel A: Two-Stage Simultaneous Equations Estimation Procedure^a

<i>Predictor Variables</i>	<i>Coefficient</i>	<i>Asymptotic Std. Error^b</i>	<i>Z-Statistic</i>	<i>P-Value (two-tail)</i>
Intercept	0.387	1.225	0.316	< 0.76
LN(SIZE)	0.458	0.237	1.933	< 0.06
FINOFFCL	0.610	0.389	1.569	< 0.12
GOVT	1.364	0.543	2.512	< 0.02
LN(FEE) (predicted) ^b	-0.838	0.484	-1.730	< 0.09

The chi-square statistic for model: 20.070 (p=0.000); pseudo-R² (Greene 1990, p. 682): 0.129

Panel B: Single-Stage Probit (for comparison purposes only)

<i>Predictor Variables</i>	<i>Coefficient</i>	<i>Asymptotic Std. Error</i>	<i>t-Statistic</i>	<i>P-Value (two-tail)</i>
Intercept	-1.078	0.808	-1.334	< 0.19
LN(SIZE)	0.060	0.085	0.711	< 0.48
FINOFFCL	0.376	0.314	1.195	< 0.24
GOVT	0.961	0.431	2.227	< 0.03
LN(FEE) (actual)	0.005	0.136	0.040	< 0.97

The chi-square statistic for model: 16.077 (p=0.003); pseudo-R² (Greene 1990, p. 682): 0.103

^aThe simultaneous equation generalized probit model, the two-stage generalized least squares estimation procedure, and the asymptotic standard errors of the coefficient estimates are described in Amemiya (1978).

^bThe value of LN(FEE) predicted by the first-stage, reduced form regression. See tables 1 and 2 for a description of other variables.

The results for the audit quality demand model indicate a negative relation between the demand for audit quality and fees. We interpret our results as suggesting that the demand for audit quality is sensitive to the fee and that higher audit fees may therefore reduce the levels of quality demanded, a finding with potential policy consequences.¹⁷

¹⁷For example, much of the official reaction to substandard audits has been to impose additional costs on auditing firms. The 1988 *Yellow Book* (GAO 1988), for example, requires additional continuing education and mandatory external quality control reviews. These costs are reflected in the audit fees of all firms, including those audit firms already providing high quality services. In the presence of a downward sloping demand for audit quality, it is conceivable that such costs might induce client entities to contract for a lower level of audit quality, a result contrary to policymakers' likely intentions.

Table 4

Comparison of Simultaneous Equations vs Single Equation Parameter Estimates of the Supply Function for Audit Quality Based upon the Logarithm of Audit Fees (LN(FEE)) Charged by CPA Firms in 118 Audit Engagements Sampled from a Population of Audits of Federal Assistance Programs by the U.S. General Accounting Office in 1985

Panel A: Two-stage Simultaneous Equations Estimation Procedure^a

<i>Predictor Variables</i>	<i>Coefficient</i>	<i>Asymptotic Std. Error^b</i>	<i>Z-Statistic</i>	<i>P-Value (two-tail)</i>
Intercept	2.993	0.870	3.440	< 0.01
LN(SIZE)	0.410	0.058	7.036	< 0.01
LN(#BIDS)	-0.036	0.150	-0.240	< 0.81
COSTWGHT	-0.792	0.319	-2.248	< 0.02
TENURE	0.088	0.030	2.915	< 0.01
QUALINDX ^b	0.465	0.274	1.699	< 0.09

The F-statistic for model: 76.188 (p=0.000); Adjusted-R²: 0.763

Panel B: Single-stage Ordinary Least Squares (for comparison purposes only)

<i>Predictor Variables</i>	<i>Coefficient</i>	<i>Asymptotic Std. Error</i>	<i>t-Statistic</i>	<i>P-Value (two-tail)</i>
Intercept	1.961	0.531	3.692	< 0.01
LN(SIZE)	0.473	0.035	13.423	< 0.01
LN(#BIDS)	0.011	0.122	0.087	< 0.93
COSTWGHT	-0.619	0.249	-2.486	< 0.01
TENURE	0.073	0.024	3.085	< 0.01
QUALDUM	0.215	0.171	1.257	< 0.22

The F-statistic for model: 73.547 (p=0.000); Adjusted-R²: 0.756

^aThe simultaneous equation generalized probit model, the two-stage generalized least squares estimation procedure, and the asymptotic standard errors of the coefficient estimates are described in Amemiya (1978).

^bThe value of QUALINDX predicted by the first-stage, reduced form probit analysis of QUALDUM. QUALINDX is an unobserved latent index of audit quality and QUALDUM is an observable qualitative variable such that QUALDUM = 1 if, and only if, QUALINDX > 0. See tables 1 and 2 for a description of other variables.

A comparison of empirical results using a two-stage simultaneous equations estimation procedure with those of single equation analysis (probit or OLS) reveals differences in the inferences between the two estimation procedures. These differences suggest the presence of simultaneous equations bias within the audit fee/audit quality relation, which may explain inconsistent results obtained for other quality measures employed in single equation audit fee analyses.

References

- Amemiya, T. 1978. The estimation of a simultaneous equation generalized probit model. *Econometrica* 46 (September): 1193-205.
- American Institute of Certified Public Accountants (AICPA). 1978. *Report, Conclusions and Recommendations of the Commission on Auditors' Responsibilities*. New York: AICPA.
- . 1986. *Restructuring Professional Standards to Achieve Professional Excellence in a Changing Environment*. New York: AICPA.
- Bachar, J. 1989. Audit quality, signaling, and underwriting contracts. *Contemporary Accounting Research* (Fall): 216-42.
- Beatty, R. P. 1989. Auditor reputation and the pricing of initial public offerings. *The Accounting Review* 64 (October): 693-709.
- Beck, P. J., and R. M. Barefield. 1986. An economic analysis of competitive bidding for public sector audits. *Journal of Accounting and Public Policy* 5 (Fall): 143-65.
- Belsley, D. A., E. Kuh, and R. E. Welsch. 1980. *Regression Diagnostics: Identifying Influential Data Points and Sources of Collinearity*. New York: John Wiley and Sons.
- Chow, C. W. 1982. The demand for external auditing: Size, debt and ownership influences. *The Accounting Review* 57 (April): 272-91.
- , W. L. Kramer, and W. A. Wallace. 1988. The environment of auditing. In *Research Opportunities in Auditing: The Second Decade*, edited by A. R. Abdel-khalik and I. Solomon, 155-83. Sarasota, FL: American Accounting Association.
- Copley, P. A. 1991. The association between municipal disclosure practices and audit quality. *Journal of Accounting and Public Policy* 10 (Winter): 245-66.
- , and M. S. Doucet. 1993. The impact of competition on the quality of governmental audits. *Auditing: A Journal of Practice & Theory* 12 (Spring): 88-98.
- Datar, S., G. Feltham, and J. Hughes. 1991. The role of audits and audit quality in valuing new issues. *Journal of Accounting and Economics* 14 (March): 3-49.
- DeAngelo, L. 1981. Auditor size and audit quality. *Journal of Accounting and Economics* 3 (December): 183-99.
- Deis, D. R., Jr, and G. A. Giroux. 1992. Public sector evidence of product differentiation effects on audit price and audit effort. Working Paper, Louisiana State University, Baton Rouge.
- Elliott, R. K., and A. Korpi. 1978. Factors affecting audit fees. In *Cost-Benefit Analysis of Auditing*, edited by M. Shakun, 17-25. New York: AICPA.
- Evans, J. H., and J. M. Patton. 1983. An economic analysis of participation in the municipal finance officers association certificate of conformance program. *Journal of Accounting and Economics* 5 (December): 151-75.
- Feltham, G., H. Hughes and D. Simunic. 1991. Empirical assessment of the impact of auditor quality on the valuation of new issues. *Journal of Accounting and Economics* 14 (December): 375-99.
- Francis, J. R. 1984. The effect of audit firm size on audit prices. *Journal of Accounting and Economics* 6 (Autumn): 133-51.
- , and D. T. Simon. 1987. A test of audit pricing in the small-client segment of the U.S. audit market. *The Accounting Review* 62 (January): 145-57.
- Gaver, K., R. King, and T. O'Keefe. 1992. The role of audit firm knowledge and fees in explaining violations of GAAS reporting standards. Working Paper, University of Oregon, Eugene.
- Greene, W. H. 1990. *Econometric Analysis*. New York: Macmillan.
- Heckman, J. J. 1978. Dummy endogenous variables in a simultaneous equation system. *Econometrica* 46 (July): 931-60.
- Klein, B., and K. B. Leffler. 1981. The role of market forces in assuring contractual performance. *Journal of Political Economy* (August): 615-41.
- Maddala, G. S. 1983. Limited-dependent and qualitative variables in econometrics. *Econometric Society Monographs No. 3*. Cambridge: Cambridge University Press.

- Palmrose, Z. 1984. The demand for quality-differentiated audit services in an agency cost setting: An empirical investigation. In *Sixth Symposium on Auditing Research*, edited by A. R. Abdel-khalik and I. Solomon, 229-52. Champaign: University of Illinois.
- _____. 1986. Audit fees and auditor size: Further evidence. *Journal of Accounting Research* 24 (Spring): 97-110.
- Rubin, M. A. 1988. Municipal audit fee determinants. *The Accounting Review* 63 (April): 219-36.
- Simunic, D. A. 1980. The pricing of audit services: Theory and evidence. *Journal of Accounting Research* 18 (Spring): 161-90.
- _____, and M. Stein. 1987. *Product Differentiation in Auditing: Auditor Choice in the Market for Unseasoned New Issues*. Vancouver, BC: The Canadian Certified General Accountant Research Foundation.
- Treadway Commission. 1987. *Report of the National Commission on Fraudulent Financial Reporting*. New York: AICPA.
- United States General Accounting Office (GAO). 1987. *CPA Audit Quality: A Framework for Procuring Audit Services*. Washington, DC: GAO.
- _____. 1988. *Government Auditing Standards*. Washington, DC: GAO.
- Wallace, W. A. 1980. *The Economic Role of the Audit in Free and Regulated Markets*. New York: Touche Ross & Co.
- _____. 1986. The timing of initial independent audits of municipalities: An empirical analysis. *Research in Governmental and Nonprofit Accounting* 2: 3-51.
- Watts, R. L., and J. L. Zimmerman. 1983. Agency problems, auditing, and the theory of the firm: Some empirical evidence. *The Journal of Law and Economics* (October): 613-33.

The Effect of Containment Information and Error Frequency on Projection of Sample Errors to Audit Populations

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SYNOPSIS AND INTRODUCTION: This paper builds upon the work of Burgstahler and Jiambalvo (1986a, 1986b) on auditors' estimation of error through sampling. Burgstahler and Jiambalvo used a ball-and-urn inference model to argue that the isolation of sample errors violates professional auditing standards. They speculated that context-specific data about sample errors induces uniqueness perceptions that, in turn, cause auditors non-normatively to isolate the errors. We extend their research by manipulating two variables they suggested, but did not test: (1) containment information, which indicates whether the discovered error is limited to a well-defined subpopulation of unsampled items; and (2) perceived frequency of errors, which is directly related to the similarity of an error to other potential errors.

Our results show that containment information strongly affects the projection-isolation decision, regardless of the perceived frequency of the error. In our empirical work, error frequency also affects the judgment. These findings suggest that containment information does not affect the decision solely by inducing perceptions of uniqueness but rather has a direct effect on it. Additional research is needed to describe and understand more fully this important judgment.

Key Words: *Audit sampling, SAS no. 39, Containment information, Accounting errors, Error frequency, Error estimation.*

Data Availability: *The data may be obtained from the authors.*

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I. Development of Hypotheses

BURGSTAHLER and Jiambalvo (1986b) investigated auditors' projection-isolation decisions and developed a normative model using a uniqueness construct from a ball-and-urn model. Burgstahler and Jiambalvo discovered that auditors believed the errors they isolated were less similar to errors other than the ones they projected.¹ Combining empirical data and their normative perspective, Burgstahler and Jiambalvo argued that auditors misperceive the similarity of sample errors and unsampled errors. They concluded that auditors' misperceptions of uniqueness routinely cause them to make non-normative judgments in audit sampling applications.

The normative issues regarding the isolation of sample errors deserve to be revisited from both a statistical and professional-standard point of view.² However, our objective in this study is to clarify a portion of the empirical work presented in Burgstahler and Jiambalvo (1986b). They did not identify or manipulate specific variables, but their notion of a "similarity match" involved two types of data: (1) a context-specific type of information about the extent of the error due to explicit client circumstances, and (2) a more general notion of how similar the error is to other potential errors in the population.

The context-specific information was data about the auditor's required investigation of the nature and cause of discovered misstatements (AICPA 1992, AU § 350.27). Such investigations are often conducted by examining previously unsampled sub-populations of transactions in which the error might plausibly recur. For example, an error caused by a temporary clerk might result in the examination of all transactions processed by that clerk. This investigation produces information about whether the error is known to be confined to a sub-set of examined items, and we, therefore, term this data *containment information*.

Burgstahler and Jiambalvo speculated that context-specific information induced similarity/uniqueness perceptions that, in turn, caused the auditor to project or isolate the error. In such a model, containment information does not have a direct effect; it influences the decision only indirectly by causing a dissimilarity perception. To clarify how containment information and similarity perceptions affect the projection-isolation decision, independent manipulation of containment information and error similarity is necessary.

The general notion of similarity is based on relative frequencies (Kahneman and Tversky 1973; Tversky 1977). Errors perceived to be frequently occurring should also be perceived as more similar to other potential errors (see footnote 1). Burgstahler and Jiambalvo (1986b) referred to a prototype matching to describe auditors' judgments of similarity. Using this framework, the matching of a specific error to some prototypical error must succeed more often, on average, for more- than for less-frequent errors. More importantly, the perceived frequencies of errors are independent of the context-specific containment information auditors obtain when investigating sample errors. Although we expect both factors to affect auditors' judgments, we hypothesize that

¹Professional standards require auditors to investigate the cause of material misstatements. In Burgstahler and Jiambalvo's research and in ours, the word "error" encompasses both the misstatement and its cause. Therefore, an error is similar to other potential errors, and has high causal similarity, if its cause is similar to that of other errors. Likewise, errors dissimilar to other errors have low causal similarity.

² Burgstahler and Jiambalvo's normative standard has yet to be challenged. However, using error rates and sample sizes that make the demonstration non-trivial in an audit context, the mean square error of the estimator can be smaller when unique errors are isolated than when they are projected. Such a demonstration shows that standards of statistical inference do not always prescribe the projection of all errors belonging to a sample.

containment information will have a direct effect and will dominate perceptions of general similarity.

Two hypotheses follow from distinguishing these two constructs:

- H1: The presence of containment information will be associated with the isolation of sample errors, while the absence of such information will be associated with the projection of sample errors.
- H2: The perceived frequency of errors will affect the projection-isolation decision. Errors perceived to occur more frequently will be projected more often than errors perceived to occur less frequently.

II. Experimental Design

In a 2 x 2 factorial design, we manipulated both containment information and error frequency across two levels. The presence or absence of containment information was manipulated between subjects, while error frequency was a within-subjects variable. There were four cases: two involved errors with a higher relative frequency, and two had errors with lower relative frequency. The four cases were randomly arranged using a subset of a Latin-square, so that each error comprised each position for a subset of subjects (Winer 1971).

Subjects

One hundred and five auditors from an international accounting firm with average experience of 3.3 years participated in the experiment during a staff school for seniors. Based on Abdolmohammadi and Wright (1987) and consistent with related research (Kachelmeier and Messier 1990; Butler 1985), we considered audit seniors the appropriate subjects for this semi-structured task.

Materials

Three of the cases were modeled after those used by Burgstahler and Jiambalvo (1986b). However, to manipulate causal similarity and containment information independently, some minor wording adjustments were made and another case was added.

Containment information was manipulated by including or excluding information on the extent of the error. The contained errors were described as part of a well-defined sub-population in which every transaction had been investigated further for error, and none had been found. The subjects in the treatment without containment information received identical cases without the information on the additional investigation of the sub-population.

We relied on previous empirical data and the accepted assumption that irregularities are less common than unintentional errors to ensure that the sample errors differed in frequency.³ The two errors classified as having relatively higher frequency were a footing error in a credit memo and unearned interest included in sales. Both of these cases were used by Burgstahler and Jiambalvo (1986b). The two errors classified as having relatively lower frequency were deliberate misfooting of an invoice where the temporary employee was a relative of the audit client's customer and

³Ramage et al. (1979), Johnson et al. (1981), Coakley and Loebbecke (1985), Ham et al. (1985), Libby (1985), Butt (1986), and Kreutzfeldt and Wallace (1986) provided data regarding auditors' perceptions of the frequency of financial statement errors and irregularities. Libby also provided a small set of archival data. We relied on these empirical findings to determine that errors are more common than irregularities. Additionally, we verified that our subjects shared these perceptions using a post-experimental questionnaire.

fictitious sales submitted by a commissioned salesperson. The first case was used by Burgstahler and Jiambalvo, and we added the second.

The choice of irregularities for the lower level of causal similarity was based on two factors. First, we wanted to use Burgstahler and Jiambalvo's cases as much as possible to enable comparison of results. Second, we wanted to use errors that were unambiguously dissimilar to other potential errors. The data analysis assessed and substantiated the effectiveness of this manipulation.

Procedure

After reading a case, subjects were asked to identify the cause of the error, rate the cause with respect to its similarity to other errors, and make a projection-isolation decision.⁴ After completing the cases, subjects were asked to rank order the error causes used in the cases with respect to perceived frequency.

III. Results

Before analyzing the data, we checked to be sure that the subjects correctly identified the causes of the errors. This step ensured that subjects were not including the containment information as part of the cause. In approximately 90 percent of the cases, subjects correctly identified the cause of the error. We then assessed the association between the projection-isolation choices and the ratings of the similarity of the errors to other potential errors. This association was the basis of Burgstahler and Jiambalvo's hypothesis that perceptions of uniqueness prevented casual similarity matches. Using *t*-tests, we found that the similarity ratings of isolated errors were significantly lower than the ratings of projected errors at *p*-values of less than 0.04 in all cases.⁵ Thus, our study successfully replicated Burgstahler and Jiambalvo's results.

The following results confirm the effectiveness of our manipulations: (1) the perceived relative frequencies of both higher-frequency errors were significantly higher than the perceived relative frequencies of the lower-frequency errors ($p < 0.001$); (2) the higher-frequency errors received higher causal similarity ratings than the lower-frequency errors ($p < 0.01$); and (3) the frequency rankings and the containment information were independent. The last result was confirmed in a repeated-measures ANOVA in which the frequency rankings of the four errors were the dependent variables, and the presence of containment information was the independent variable. In this analysis, the frequency rankings of the cases were significant for all contrasts between the more- and less-frequent errors ($p < 0.001$), which confirms the frequency manipulation, but containment information had no significant effect on the subjects' frequency rankings.

Hypothesis H1 predicts that containment information will affect the projection-isolation choice. We tested this hypothesis for each case by comparing the percentages of isolation choices in the containment condition to those in the no-containment condition. Chi-squared statistics measuring the effect of containment information were significant at conventional levels for all four errors, as shown in table 1. Regardless of error frequency, the availability of containment information increased the isolation rate of sample errors, a result which supports hypothesis H1.

⁴ We varied the order of the questions and confirmed the absence of order effects.

⁵ Burgstahler and Jiambalvo used the association between the judgment and the similarity rating to conclude that a similarity matching process explains the judgment. An association between the two does not necessarily mean that the similarity perceptions cause the judgment. Instead, both may be caused by some other variable, or the judgment may influence the similarity rating. In contrast, error frequency is an objective measure of causal similarity that is manipulable independent of the judgment.

Table 1
Percentage of Isolation Choices

	<i>Isolation Choices (%)</i>			
	<i>Containment Condition (n=52)</i>	<i>No-Containment Condition Chi-squared</i>		
<i>Cases (n=53)</i>			<i>p-value</i>	
More-frequent Errors:				
Credit memo	66	10	35.43	0.0001
Unearned interest	68	23	21.27	0.0001
Both combined	67	16	40.38	0.0001
Less-frequent Errors (Irregularities):				
Fraudulent mis- footing	49	37	1.68	0.0980
Fictitious sales	43	23	4.88	0.0056
Both combined	46	30	4.34	0.0570

Hypothesis H2 predicts that the general frequency of an error will affect the projection-isolation decision. The proportions of isolation choices in table 1 suggest that, while there is a definite difference between the more- and less-frequent error treatments, the effect of error frequency is different for the two levels of containment information. Specifically, the availability of containment information increased the isolation of more-frequent errors by 51 percentage points (from the no-containment condition), but the isolation of less-frequent errors increased only 16 percentage points. The interaction between containment information and error frequency, tested using a procedure suggested by Langer and Abelson (1972), was significant ($p \leq 0.001$), indicating that error frequency had a different effect when containment information was available. Consequently, the tests for the effect of error frequency were performed separately, depending on the presence or absence of containment information.

To test this hypothesis, we calculated a net isolation score for each subject.⁶ Across the four error types, a subject could isolate 0, 1, or 2 errors, and 0, 1, or 2 irregularities. For each subject, we subtracted the number of isolated irregularities from the number of isolated errors. A subject's score could range from -2 to +2. The effect of error frequency was significant in both the containment condition and the no-containment condition. The subjects in the no-containment condition, on average, isolated more irregularities than errors (a mean isolation score of -0.269, $p \leq 0.042$). However, the subjects in the containment condition isolated more errors than irregularities (a mean isolation score of 0.415, $p \leq 0.002$).

⁶We selected this dependent variable because of the within-subjects frequency manipulation. We could not directly compare the number of isolation and projection choices since the observations were not independent.

These results support Hypothesis H2 in one sense—the frequency of the errors did affect the projection-isolation decision. However, the effect of frequency was different depending on the presence or absence of containment information. In the no-containment condition, frequency had the predicted effect: the less-frequent errors were isolated more often than the more-frequent errors. In contrast, when containment information was present, the less-frequent errors were projected more often than the more-frequent errors. Both effects were statistically significant at conventional levels.

IV. Summary and Discussion

We examined the effects of containment information and error frequency on the projection-isolation decision, extending the work of Burgstahler and Jiambalvo (1986b). Our results indicate that context-specific data obtained in the investigation of a sample error, *containment information*, had a strong effect on the projection-isolation judgment. Specifically, contained errors were isolated more often than uncontained errors, regardless of perceptions of error frequency.

The frequency of errors also affected the projection-isolation decision, but the nature of the effect was contingent upon the availability of containment information. In the absence of containment information, error-frequency had the predicted effect: more-frequent errors were isolated less often than less-frequent errors. However, in the presence of containment information, subjects isolated the more-frequent errors more often than the less-frequent errors. This result, in the opposite direction of our hypothesis, may be a direct function of the use of irregularities to represent less-frequent errors. The discovery of an irregularity, while normally rare and thus dissimilar to other errors, should induce additional caution (AICPA 1992, AU § 350.27) and might result in higher projection rates.

There are several possible extensions of this research. One is to explore whether or not auditors can make use of relative frequencies that are less extreme (i.e., errors versus irregularities) than those used in this experiment. Another is the interaction between frequency and containment information. Processing containment information may increase auditors' attention to error characteristics in general. Finally, if the projection of all errors belonging to a sample is not normatively prescribed, then alternative norms need to be researched. Both theoretical and simulation approaches (e.g., the rectification procedure investigated by Wurst et al. 1991) may shed light on error-estimation procedures when sample errors are investigated (often isolated) and corrected. This line of research helps to gain information about how auditors decide whether to project or isolate an error discovered in sampling. As firms learn more about the distributions of certain errors in audit populations, the knowledge gained from these experiments may be useful in providing explicit guidelines for auditors in this decision task.

Appendix

Experimental Cases

Note: The four experimental cases are given below. Cases 1 and 2 involve relatively more frequent errors, and cases 3 and 4 involve relatively less frequent errors. The questions shown below with case 1 were repeated after each case; and the cases were presented on separate pages. The italicized sentences are the containment information which was included (without italics) in the containment information treatments. The italicized sentences did not appear in the no-containment information cases. Complete experimental materials are available from the authors upon request.

Case 1

(1) Account No. 593 was overstated by \$1,687.37 due to an error on a credit memorandum. (2) The client apparently misfooted the invoices related to the credit by \$1,687.37. (3) *In total, only 85 credit memos were issued during the year.* (4) *To evaluate the extent of the error uncovered, the auditor examined all credit memos and checked the amounts by footing the totals on supporting documents.* (5) *No additional footing errors were noted.*

1. Please give the number of the sentence in the case which best describes the cause of the error. (Give only one.) _____

2. Considering only the sentence that you selected as the cause of the error and no other information in the case, how similar is this cause to the causes of other potential errors found during an audit?

	—		—		—		—		—		—		—		—		—		—	
1		2		3		4		5		6		7								
Not similar										Very similar										
at all																				

3. The error in this case should be: (select one)

a. included in the sample estimate _____
(projected)

b. excluded from the sample estimate _____
(isolated)

Case 2

(1) Account No. 2947 was overstated by \$1,865.00. (2) During December, the client agreed to sell \$24,867.00 in merchandise to this customer with payment due in six months and 15% interest. (3) An accounting clerk recorded the sale including unearned interest in the selling price. (4) *Discussion with client personnel indicated that all other sales were at the normal terms of PAYMENT DUE ON DELIVERY and did not include interest charges.* (5) *A special exception was made for this customer to obtain his business.* (6) *Numerous tests of sales transactions were conducted by the auditor throughout the year.* (7) *No sales arrangements including terms other than PAYMENT DUE ON DELIVERY were noted.*

Case 3

(1) Account No. 841 was understated by \$1,945.85. (2) Nonetheless, the customer confirmed the proper balance. (3) It was determined that a clerical employee, who was related to a senior employee of the client's customer, deliberately misfooted sales invoices for the account and forged the initials of the superior who reviews all invoices for accuracy. (4) *The auditor has determined that the employee was temporary and has examined all invoices processed by the clerical employee for the customer under consideration and found no additional errors.* (5) *Also, the auditor examined an additional sample of invoices for other customers processed by the temporary clerical employee and found no additional errors.*

Case 4

(1) Account No. 8227 was overstated by \$1,456.72 due to a fictitious sale submitted by a salesman. (2) It appeared to be part of an effort to boost his sales near the end of the first quarter. (3) *The auditors' investigation revealed that the employee, who began working for the client in mid-January, was dismissed at the beginning of April due to customer complaints, but the client had not uncovered this fraud.* (4) *The auditors examined all sales made by this salesman during the year and found no other fictitious sales.* (5) *All amounts were verified by documentation and by confirmation with customers.*

References

- Abdolmohammadi, M., and A. Wright. 1987. An examination of the effects of experience and task complexity on audit judgments. *The Accounting Review* 62 (January): 1-13.
- American Institute of Certified Public Accountants. 1992. *AICPA Professional Standards*. Vol. I. Chicago: Commerce Clearing House.
- Burgstahler, D., and J. Jiambalvo. 1986a. Isolation of errors in audit sampling. *CPA Journal* 56 (November): 66-71.
- _____, and _____. 1986b. Sample error characteristics and projection of error to audit populations. *The Accounting Review* 61 (April): 233-48.
- Butler, S. 1985. Application of a decision aid in the judgmental evaluation of substantive test of details samples. *Journal of Accounting Research* 23 (Autumn): 513-26.
- Butt, J. 1986. Frequency judgments in auditing. Ph.D. dissertation, University of Michigan, Ann Arbor.
- Coakley, J., and J. Loebbecke. 1985. The expectation of accounting errors in medium-sized manufacturing firms. *Advances in Accounting* 2: 199-246.
- Ham, J., D. Losell, and W. Smieliauskus. 1985. An empirical study of error characteristics in accounting populations. *The Accounting Review* 60 (July): 387-406.
- Johnson, J., R. Leitch, and J. Neter. 1981. Characteristics of errors in accounts receivable and inventory audits. *The Accounting Review* 56 (April): 270-93.
- Kachelmeier, S., and W. Messier, Jr. 1990. An investigation of the influence of a nonstatistical decision aid on auditor sample size decisions. *The Accounting Review* 65 (January): 209-26.
- Kahneman, D., and A. Tversky. 1973. On the psychology of prediction. *Psychological Review* 80 (July): 237-51.
- Kreutzfeldt, R., and W. Wallace. 1986. Error characteristics in audit populations: Their profile and relationship to environmental factors. *Auditing: A Journal of Practice & Theory* 6 (Fall): 20-43.
- Langer, E., and R. Abelson. 1972. The semantics of asking for a favor: How to succeed in getting help without really dying. *Journal of Personality and Social Psychology* 24 (1): 26-32.
- Libby, R. 1985. Availability and the generation of hypotheses in analytical review. *Journal of Accounting Research* 23 (Autumn): 648-67.
- Ramage, J., R. Krieger, and L. Spero. 1979. An empirical study of error characteristics in audit populations. *Journal of Accounting Research* 17 (Supplement): 72-102.
- Tversky, A. 1977. Features of similarity. *Psychological Review* 84 (July): 327-52.
- Winer, B. J. 1971. *Statistical Principles in Experimental Design*. New York: McGraw-Hill.
- Wurst, J., J. Neter, and J. Godfrey. 1991. Effectiveness of rectification in audit sampling. *The Accounting Review* 66 (April): 333-47.

Some Evidence on the News Content of Preliminary Earnings Estimates

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SYNOPSIS AND INTRODUCTION: This article provides evidence on the news content of managements' preliminary earnings estimates, which we define as projections of earnings conveyed in expectational language after the end of the reporting period but before the release of final earnings numbers. We examine stock price changes to assess whether a preponderance of these disclosures are interpreted as "good news" by investors, and the extent to which good news releases are disclosed earlier than bad news.

Associated with preliminary earnings estimates are disclosure and timing issues. While previous theoretical work suggests managers have incentives to suppress or delay disclosure of adverse information (Verrecchia 1983; Dye 1985), studies examining the disclosure issue using management forecasts produced inconsistent results, and results on the timing of corporate earnings announcements are ambiguous.

Although there is evidence on the information content of preliminary earnings estimates (Foster 1973), no study has used these data in investigating the relation between corporate disclosure and news content. Preliminary estimates are important because they embody aspects of disclosure choice similar to other voluntary disclosures such as forecasts, and the time lags between preliminary estimates and earnings releases are short, thereby assuring a strong timing aspect to their release.

We document significant negative mean abnormal returns associated with the disclosure of preliminary estimates. The median is negative, but not significant at conventional levels. Tests on the timing issue indicate an ambiguous relation

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between disclosure timing and news content. Preliminary estimates of quarters 1-3 earnings are more likely to be bad news compared to estimates of quarter 4 and annual earnings, but within quarters there is no strong relation between news content and disclosure timing.

Key Words: *Preliminary earnings estimates, Corporate disclosure, Stock prices.*

Data Availability: *Analyst forecasts are proprietary and must be obtained from IBES, Inc. Requests for any data available from public sources used in this study should indicate their intended use. Data will be provided when requests do not conflict with the authors' future use of these data.*

THIS article is organized as follows. Section I describes prior research on the relation between corporate disclosure and news content. Sample selection and data are described in section II. Section III defines the stock return measure of news content and related significance tests. Empirical results are reported in section IV, followed by a brief summary in section V.

I. Prior Research

The suppression or delay of public disclosure of unfavorable information underlies several aspects of the federal securities laws—e.g., disclosure requirements for auditor changes in SEC Form 8-K. Such behavior is also predicted by prior theories of voluntary disclosure (Verrecchia 1983; Dye 1985; Jung and Kwon 1988). However, other analyses suggest that corporate managers have incentives to disclose both good and bad news (King et al. 1990; Teoh and Hwang 1991).

Several empirical studies have examined the disclosure issue using price changes associated with management earnings forecasts, but the results appear to be dependent on the sample period. Studies using data from the 1960s and early 1970s find that a majority of management forecasts are interpreted as favorable news items (Patell 1976; Penman 1980). Using a more recent sample, McNichols (1989) finds no evidence to suggest that her sample is dominated by good news forecasts.¹

The timing issue has been examined for earnings announcements, and to a lesser extent, other disclosures such as earnings forecasts. Chambers and Penman (1984), Givoly and Palmon (1982), Kross and Schroeder (1984), McNichols (1988), and Patell and Wolfson (1982) provide evidence suggesting bad news is disclosed later than good news for earnings announcements. Pastena and Ronen (1979) document that forecasted earnings declines are more likely to be disclosed late within the fiscal year. On the other hand, Ball and Kothari (1991) find no evidence to support the hypothesis that adverse earnings news is reported later, and Skinner (1992) documents that firms are more likely to disclose unfavorable earnings news early. Hence, recent research offers mixed results for the timing effects.

II. Sample Selection and Data

The sample of preliminary earnings estimates was obtained as described in panel A of table 1. An initial sample of 5,031 earnings forecasts and preliminary estimates was generated from the

¹ One interpretation of these results is that managers are now subject to greater liability risks for undisclosed bad news than was the case in the 1960s and early 1970s (Skinner 1992).

Table 1
Sample Selection Process and Distribution of Disclosure Types
(400 Preliminary Earnings Estimates: 1983-86)

Panel A. Sample Selection Process:

Original Number of Disclosures	5,031
Disclosures by Foreign Firms and Articles which were not Firm-Specific	
Projections of Quarterly or Annual Reports	(1,233)
Disclosures by firms not Listed on Both COMPUSTAT and CRSP	(1,428)
Disclosures by Firms with Insufficient CRSP Data	(220)
Forecasts Issued <i>Before</i> Period End	(1,750)
Preliminary Estimates Issued <i>After</i> Period End	<u>400</u>

Panel B. Distribution by Type of Disclosure:

Type of Disclosure	Total	
	No.	%
Point Estimates ^a	132	33.0
Range Estimates ^b	65	16.2
Min or Max Estimates ^c	184	46.0
General Impression Estimates ^d	19	4.8
Total	<u>400</u>	<u>100.0</u>

Panel C. Frequency of Preliminary Estimates by Sample Firms:

Estimates	Firms
One	202
Two	67
Three	15
Four	1
Five	3
Total	<u>288</u>

^a Point estimates are those where a specific estimate is disclosed such as "Earnings will be X this period."

^b Range estimates are closed-end interval projections of the form "Earnings will be between X1 and X2 this period."

^c Minimum and maximum estimates are lower and upper bound projections, respectively, of earnings. A minimum estimate is of the form "Earnings will be greater than X1 this period" while a maximum estimate might be phrased "Earnings will be no more than X2 this period."

^d General impression estimates can be of the form "Earnings will be good this year compared to last year."

Dow Jones News Retrieval Service (DJNRS) during the period 1 January 1983 through 31 December 1986. Disclosures that pertained to foreign firms or were not firm-specific were omitted. Disclosures by firms not included in the COMPUSTAT and CRSP databases were also omitted. Additional disclosures were lost due to insufficient data on CRSP. Of the remaining 2,150 disclosures, 400 represent preliminary earnings estimates disclosed after the end of the reporting period. These 400 disclosures (by 288 firms) constitute our primary sample. Although the 1,750 earnings forecasts are not included in the primary sample, we do examine stock price changes for these disclosures in some tests as a benchmark in evaluating the price effects of preliminary estimates.

Panel B of table 1 describes the frequency of alternative types of preliminary estimates within the primary sample. The releases are partitioned into four types: (1) point estimate; (2) range estimates where both an upper and lower bound are provided; (3) minimum and maximum estimates where either a lower or upper bound are released; and (4) general impression estimates where management indicates only that earnings will be "good" or "bad." As shown in table 1, point estimates comprise 33 percent of the preliminary earnings estimate sample, compared with 19 percent of the management forecast sample used in Pownall et al. (1993). Also 21.1 percent of the 1,750 earnings forecasts we identified are point projections.²

Panel C of table 1 indicates that 202 companies have only one preliminary estimate entering the sample, 67 have two sample estimates, 15 companies have three sample estimates, one has four estimates, and three firms have five disclosures. The mean (median) number of trading days between disclosure of the preliminary estimate and the earnings report is 12.75 (10.5).

III. Stock Returns Measurement

We study stock price changes associated with the disclosure of preliminary earnings estimates. If managers disclose favorable information selectively, then these stock price changes will be positive (on average). Also, the price effects of earlier disclosures will be more positive if managers hasten disclosure of favorable information. We use stock price changes to classify disclosures as good or bad news since projected earnings changes are difficult to evaluate for certain disclosures such as when only minimum or maximum estimates are known.

We focus on a three-day event window centered on the preliminary earnings estimate disclosure date with day 0 being the date of disclosure identified by the DJNRS.³ For each sample disclosure, we computed abnormal returns (AR_{it}) on event days -1, 0, and +1 according to the market model, using the CRSP equally-weighted market index and regression parameters estimated between days -230 and -31. Abnormal returns were then summed to calculate a cumulative abnormal return (CAR_{it}) over the three-day period.

We examine the cross-sectional mean and median CAR for the full sample of 400 disclosures and for relevant subsamples. The significance of the mean CAR is assessed using the Z-test employed by Patell (1976), and the median is evaluated using a Sign test.⁴

IV. Empirical Results

The Disclosure Issue: News Content of Preliminary Earnings Estimates

Table 2 provides summary statistics on the cross-sectional CAR distribution for the full sample and subsamples categorized by IBES analyst following, disclosure type, and disclosure frequency. The IBES sample includes preliminary earnings estimates by firms for which quarterly and annual analysts' forecasts are available on IBES immediately before disclosure of

² Baginski and Hassell (1992) also find a positive relation between forecast horizon and forecast specificity.

³ A three-day window insures that price effects are fully captured for announcements released outside of trading hours. Some announcements show a Broad Tape disclosure time after trading closes. Incorporating day +1 for these events ensures that their price effects are captured in the return measure. In a few cases, only a *Wall Street Journal* disclosure date is available. Using day -1 for these cases aids in identifying stock price effects. For evidence on intraday disclosure timing and stock price behavior, see Patell and Wolfson (1982). We also examined a longer event window including the 60 trading days surrounding this period. A longer event window had no material impact on our conclusions.

⁴ See equation (11) from Patell (1976). We replicated our results using a t-test calculated as the ratio of the mean CAR to the cross-sectional standard deviation divided by the square root of sample size. These results were qualitatively similar to those we report.

Table 2
Summary Statistics on Cumulative Abnormal Returns (CAR) for
a Three-Day Event Window Centered on the Disclosure Date
(400 Preliminary Earnings Estimates: 1983-86)

<i>Sample</i>	<i>N</i>	<i>Mean^a</i>	<i>Z-Test P-Value^b</i>	<i>Median^c</i>	<i>#(%)>0^d</i>	<i>Sign Test P-Value^e</i>
Full Sample	400	-0.0090	0.009	-0.0044	193 (48.3)	0.497
<i>By Analyst Following</i>						
IBES Sample	186	-0.0088	0.043	-0.0028	91 (48.9)	0.764
Non-IBES Sample	214	-0.0091	0.087	-0.0050	102 (47.7)	0.502
<i>By Disclosure Type</i>						
Point	132	-0.0056	0.332	0.0036	68 (51.5)	0.734
Range	65	-0.0090	0.597	0.0008	33 (50.8)	0.897
Minimum	105	0.0185	0.001	0.0128	67 (63.8)	0.005
Maximum	79	-0.0495	0.001	-0.0415	14 (17.7)	0.001
General Impression	19	-0.0155	0.481	0.0147	11 (57.9)	0.490
<i>By Disclosure Frequency</i>						
One	202	-0.0188	0.001	-0.0122	86 (42.6)	0.036
Multiple	198	0.0011	0.591	0.0036	107 (54.0)	0.263

CAR equals the cumulative percentage abnormal return between event days -1 and +1, inclusive. Abnormal returns are estimated using a market model.

^a The mean equals the cross-sectional average CAR for a given sample.

^b P-values are for a two-tailed test calculated as in Patell (1976).

^c The median equals the median of the cross-sectional distribution of CARs for a given sample.

^d Numbers reported apply to the number and percentage of CARs within a given sample that exceed zero.

^e P-values are for a two-tailed Sign test.

the preliminary estimate. We use IBES availability as a proxy for the extent of analyst following to evaluate the conjecture by Jung and Kwon (1988) that firms not followed by analysts will more likely disclose favorable information.⁵ We also partition observations by the firms' disclosure frequency since higher frequency increases the likelihood of disclosing both good and bad news. We expect significant positive mean and median CARs if managers use preliminary estimates to communicate favorable information.

Several aspects of the results in table 2 are noteworthy. First, the mean and median CAR are both negative for the full sample. The mean CAR differs significantly from zero at the 0.009 level. However, the Sign test indicates the median does not differ (at the 0.05 level) from zero. Second, the mean and median CAR are also negative for both the IBES and non-IBES samples, and only

⁵ Within the IBES sample, we also partitioned the disclosures according to the number of analyst forecasts available before the disclosure. Our inferences were generally robust to this partition.

Table 3
Summary Statistics on Exogenous Categorical Measure of News Content

<i>Measure</i>	<i>N</i>	<i>#(%)</i> <i>Unambiguous</i> <i>Good News</i> <i>(%)^a</i>	<i>#(%)</i> <i>Ambiguous</i> <i>Good News</i> <i>(%)^b</i>	<i>#(%)</i> <i>Neutral</i> <i>News</i> <i>(%)^c</i>	<i>#(%)</i> <i>Ambiguous</i> <i>Bad News</i> <i>(%)^d</i>	<i>#(%)</i> <i>Unambiguous</i> <i>Bad News</i> <i>(%)^e</i>
Random Walk	381	138 (36.2)	53 (13.9)	12 (3.1)	33 (8.7)	145 (38.1)
Analyst Forecasts	176	63 (35.8)	29 (16.5)	5 (2.8)	15 (8.5)	64 (36.4)

^aUnambiguous good news disclosures include: 1) point estimates above expected earnings, 2) range estimates where the lower bound is greater than or equal to expected earnings, and 3) minimum estimates that are greater than expected earnings.

^bAmbiguous good news disclosures include: 1) range estimates where the midpoint exceeds expected earnings but the lower bound is below expected earnings, and 2) minimum estimates less than or equal to expected earnings.

^cNeutral news disclosures include point estimates equaling expected earnings and range estimates where the midpoint equals expected earnings.

^dAmbiguous bad news disclosures include: 1) range estimates where the midpoint is less than expected earnings but the upper bound exceeds expected earnings, and 2) maximum estimates where the upper bound is greater than or equal to expected earnings.

^eUnambiguous bad news disclosures include: 1) point estimates below expected earnings, 2) range estimates where the upper bound is less than or equal to expected earnings, and 3) maximum estimates that are less than expected earnings.

the mean CAR for the IBES sample is significantly different from zero at below the 0.05 level. Note, however, that the mean for the non-IBES sample is significant at the 0.087 level. These results suggest that news content and analyst following are unrelated for this sample.

Third, the only subsample where the mean and median CARs are positive and significant is for the minimum estimates. One possible reason for this is that minimum projections are interpreted as good news because they indicate a reduced likelihood of outcomes in the lower tail of the earnings distribution. Similarly, the mean and median CARs associated with maximum estimates are negative and highly significant ($p=0.001$). Fourth, the mean or median CAR is not positive and significant at conventional levels in any other case. Finally, negative price effects are centralized in preliminary estimates by firms that have only one disclosure entering the sample.

Table 3 describes the frequency of good and bad news disclosures based on a categorical exogenous measure of news content using random walk and analysts' forecast measures of expected earnings. The random walk expected earnings is computed as the earnings level for the same period in the prior year. We examine categorical measures since certain disclosures like minimums and maximums are not measures of central tendency.⁶ Unambiguous good (bad) news releases include point and min (max) preliminary estimates exceeding (below) expected earnings, and range estimates with a lower (upper) bound greater (less) than or equal to expected earnings. Ambiguous good (bad) news includes range estimates where the midpoint exceeds (is less than) expected earnings but the lower (upper) bound is less (greater) than expected earnings and min

⁶ We also examined unexpected earnings measures based on the difference between current estimated earnings and prior year earnings (or analyst forecasts) for the sample. Despite measurement problems for the minimum and maximum disclosures, these results are similar to those reported in table 3.

Table 4
Summary Statistics on Three-Day CAR's for Subsamples Defined According to Disclosure Timing of Preliminary Earnings Estimates

<i>Sample</i>	<i>N</i>	<i>Mean^b</i>	<i>Z-Test P-Value^c</i>	<i>Median^d</i>	<i>#(%)>0^e</i>	<i>Sign Test P-Value^f</i>
<i>Quarters 1-3</i>						
Early Estimates ^a	138	-0.0131	0.013	-0.0143	58 (42.0)	0.060
Late Estimates ^a	124	-0.0170	0.025	-0.0060	55 (44.4)	0.215
Full Sample	262	-0.0150	0.001	-0.0106	113 (43.1)	0.026
<i>Quarter 4 and Annual</i>						
Early Estimates ^a	70	-0.0006	0.920	0.0036	40 (57.1)	0.234
Late Estimates ^a	68	0.0057	0.277	0.0081	40 (58.8)	0.147
Full Sample	138	0.0024	0.416	0.0046	80 (57.9)	0.061

CAR equals the cumulative percentage abnormal return between event days -1 and +1, inclusive. Abnormal returns are estimated using a market model.

^a Early (late) estimates are those with disclosure lags less than or equal to (greater than) the cross-sectional median disclosure lag. The preliminary estimate disclosure lag is the number of calendar days between the end of the reporting period and the disclosure date of the preliminary estimate.

^b The mean equals the cross-sectional average CAR for a given sample.

^c P-values are for a two-tailed test calculated as in Patell (1976).

^d The median equals the median of the cross-sectional distribution of CARs for a given sample.

^e Numbers reported apply to the number and percentage of CARs within a given sample that exceed zero.

^f P-values are for a two-tailed Sign test.

(max) estimates less (greater) than or equal to expected earnings. Neutral releases include point estimates and ranges with midpoints equal to expected earnings. The results indicate that unambiguous good news is somewhat less frequent than unambiguous bad news, while the ambiguous disclosures are more likely to be good news.

Overall, the results suggest that our sample does not exhibit a preponderance of good news estimates. Mean and median CARs for the full sample are both negative, but only the mean is significant at conventional levels. Further, these effects are driven by firms that disclose only one sample estimate. News content is also independent of analysts' following, and the results are similar when using exogenous measures of news content.

The Timing Issue: News Content and the Timing of Preliminary Earnings Estimates

We first examined differences in news content across quarters of disclosure as well as differences according to disclosure lags within quarters. If bad news is disclosed later, we would expect fourth quarter and annual estimates to exhibit a higher proportion of bad news than estimates in the first three quarters, and for a given quarter, later releases will more likely be bad news.

Table 4 provides summary statistics on three-day CARs for subsamples of quarters 1-3 earnings estimates, or quarter 4 and annual earnings estimates. Within these subsamples, the disclosures are partitioned as "early" ("late") estimates if the disclosure lag is less than or equal

to (greater than) the median lag for the subsample. Disclosure lag is defined as the number of calendar days between the end of the period and the disclosure date.⁷

The evidence in table 4 does not suggest any strong relation between disclosure timing and news content, although earlier quarters tend to have a relatively high proportion of bad news releases. The mean and median CARs are negative for the quarters 1-3 estimates, and both tests reject the null at better than the 0.05 level. In contrast, the mean and median are positive (but only marginally significant) for the quarter 4 and annual estimates.⁸

We also examined stock price changes associated with the 1,750 management forecasts released before year end to provide further evidence on the timing issue since they are released before the preliminary estimates. The mean three-day CAR for the forecasts equals -0.011 which is significant at the 0.001 level. These results suggest that management forecasts are not likely to be more good news than preliminary estimates.⁹

As a final test, we examined stock price reactions to 52 preliminary estimates that had been preceded by a management forecast (either quarterly or annual) within the prior 12 months. The mean three-day CAR for these 52 disclosures is -0.025, which is significant at the 0.001 level using the Z-test. Also, only 36.5 percent of these disclosures have positive CARs. In contrast, the mean CAR for the 348 estimates not preceded by forecasts is -0.0065, which is significant only at the 0.062 level, and 50.0 percent of these cases have positive CARs.¹⁰ These results suggest that preliminary estimates preceded by management forecasts are more likely to be bad news compared to other preliminary estimates, which is the only evidence we find that "bad news comes late."

V. Summary

We examined preliminary earnings estimates to investigate whether managers are more likely to disclose good news, and also the extent to which good news is disclosed earlier than bad news. Several previous studies have examined one (or both) of these issues using management earnings forecasts or actual earnings announcements, but not using preliminary estimates. We document significant negative mean abnormal returns associated with preliminary estimates. Our evidence also suggests no strong relation between disclosure timing and news content. Overall, these results do not support the hypothesis that managers are more likely to disclose or to hasten the release of favorable preliminary earnings estimates.

⁷ The mean disclosure lag is 17.3 calendar days for the quarter 1-3 subsample compared to 26.7 calendar days for the quarter 4 and annual subsample. This partition is similar in spirit to that employed in Chambers and Penman (1984), except that we do not define "early" and "late" relative to a firm-specific expected disclosure date. The disclosure lag as we measure it does not necessarily capture an explicit managerial action to delay disclosure. The mean number of trading days between preliminary estimate disclosure date and the actual earnings report is 10.8 (16.4) for the quarter 1-3 (quarter 4 and annual) estimates.

⁸ Additional analysis indicates that the incidence of maximum (i.e., upper bound) estimates closely tracks the results in table 4. For example, 23.7 percent (12.3 percent) of the quarter 1-3 (quarter 4 and annual) estimates are specified as maximums.

⁹ The negative price effects for forecasts were generally more robust across subsamples within the forecast group. Mean CARs for forecasts when applying the same partitions as in table 2 were negative and significant at better than the 0.002 level in all but two cases. The mean three-day CAR for range (minimum) forecasts was -0.005 (0.0048), with a Z-test p-value of 0.083 (0.114).

¹⁰ We performed several variants of this test using alternative horizons (e.g., three months) and requirements of disclosure applicable to similar reporting periods. While the sample sizes were smaller, the results were similar across replications. Also, the mean three-day CAR centered on the forecast disclosure date equals -0.011 (p-value=0.001) for forecasts not followed by preliminary estimates compared to -0.0015 (p-value=0.548) for forecasts with a subsequent preliminary estimate.

References

- Baginski, S., and J. Hassell. 1992. The determinants of management forecast precision. Unpublished working paper, Florida State University, Tallahassee.
- Ball, R., and S. Kothari. 1991. Security returns around earnings announcements. *The Accounting Review* 66 (October): 718-38.
- Chambers, A., and S. Penman. 1984. Timeliness of reporting and the stock price reaction to earnings announcements. *Journal of Accounting Research* 22 (Spring): 21-47.
- Dye, R. 1985. Disclosure of nonproprietary information. *Journal of Accounting Research* 23 (Spring): 123-45.
- Foster, G. 1973. Stock market reaction to estimates of earnings per share by company officials. *Journal of Accounting Research* 11 (Spring): 25-37.
- Givoly, D., and D. Palmon. 1982. Timeliness of annual earnings announcements: Some empirical evidence. *The Accounting Review* 57 (July): 486-508.
- Jung, W., and Y. Kwon. 1988. Disclosure when the market is unsure of information endowment of managers. *Journal of Accounting Research* 26 (Spring): 146-53.
- King, R., G. Pownall, and G. Waymire. 1990. Expectations adjustment via timely earnings forecast disclosure: Review, synthesis, and suggestions for future research. *Journal of Accounting Literature* 9: 113-44.
- Kross, W., and D. Schroeder. 1984. An empirical investigation of the effect of quarterly earnings announcement timing on stock returns. *Journal of Accounting Research* 22 (Spring): 153-76.
- McNichols, M. 1988. A comparison of the skewness of stock return distributions at earnings and non-earnings announcement dates. *Journal of Accounting and Economics* 10 (July): 239-73.
- _____. 1989. Evidence of informational asymmetries from management earnings forecasts and stock returns. *The Accounting Review* 64 (January): 1-27.
- Pastena, V., and J. Ronen. 1979. Some hypotheses on the pattern of management's informal disclosures. *Journal of Accounting Research* 17 (Autumn): 550-64.
- Patell, J. 1976. Corporate forecasts of earnings per share and stock price behavior: Empirical tests. *Journal of Accounting Research* 14 (Autumn): 246-76.
- _____, and M. Wolfson. 1982. Good news, bad news, and the intraday timing of corporate disclosures. *The Accounting Review* 57 (July): 509-27.
- Penman, S. 1980. An empirical investigation of the voluntary disclosure of corporate earnings forecasts. *Journal of Accounting Research* 18 (Spring): 132-60.
- Pownall, G., C. Wasley, and G. Waymire. 1993. The stock price effects of alternative types of management earnings forecasts. *The Accounting Review* 68 (October): 896-912.
- Skinner, D. 1992. Why firms "voluntarily" disclose bad news. Unpublished working paper, University of Michigan, Ann Arbor.
- Teoh, S., and C. Hwang. 1991. Nondisclosure and adverse disclosure as signals of firm value. *Review of Financial Studies* 4: 283-313.
- Verrecchia, R. 1983. Discretionary disclosure. *Journal of Accounting and Economics* 5 (December): 179-94.

Differences in the COMPUSTAT and Expanded *Value Line* Databases and the Potential Impact on Empirical Research

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SYNOPSIS AND INTRODUCTION: The *Value Line Investment Survey* has recently expanded its database of financial information on public firms from approximately 1,600 to over 4,000 companies to be more competitive in the financial database market. In addition, recent research (Philbrick and Ricks 1991) has shown that in determining earnings surprise, *Value Line* is a better source for actual EPS data.

Since most research has been based on samples drawn from the COMPUSTAT database, increasing attention to the *Value Line* database leads one to question the effects of database choice on empirical research. One purpose of this study is to examine the differences in financial data between COMPUSTAT and *Value Line* along with the differences in the distribution of the size of firms between the two databases. Significant differences are found between COMPU-STAT and *Value Line* in the types of financial data reported for commonly used data items such as sales and total assets. In addition, the distribution of the size of firms in the databases has shifted over time. Prior to 1985 the bottom three quartiles of firms were significantly larger in *Value Line*. Beginning in 1985 the COMPUSTAT database had significantly larger firms across all quartiles.

A second purpose is to demonstrate how the differences in the two databases can materially affect inferences about the population of firms. A study analyzing effective tax rates provides a good example because the use of the different databases produces very different results. This study extends prior research by examining which differences in the databases generate these different results. Much of the difference in the results is attributable to the different firms in the two

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databases. However, after controlling for common firms, the remaining significant differences can only be attributed to differences in the manner in which the financial accounting data are assimilated into the databases.

Key Words: *Database compatibility, Effective tax rates, Firm size.*

Data Availability: *Data are available from the authors subject to licensing agreements.*

I N the next section, the two databases are compared. The effect of differences on inferences is reported in section II. Finally, conclusions and limitations are offered.

I. Database Comparisons

Reporting Differences

One of the primary differences between the COMPUSTAT and *Value Line* databases is their data assimilation policies concerning mergers and acquisitions, accounting changes, and discontinued operations. With COMPUSTAT, the dominant firm's financial data prior to the change is maintained. Restated data (25 additional data items) are provided if the firm disclosed the information in a ten-year summary.¹ If the target continues to report financial information after the merger, its data is reported as a subsidiary. Otherwise, the firm's data prior to merger or acquisition becomes part of the COMPUSTAT research file.

On the other hand, *Value Line* does not restate data for business combinations.² Historical data for the dominant firm prior to the merger is unaffected. If the target firm ceases to report financial data, the data series terminates at the point of the combination, and the firm may be retained in the database on a short-term basis for analysis. Periodically, these firms are eliminated from the database. Also, *Value Line* reports financial data for foreign firms in foreign currency,³ while COMPUSTAT restates the data in U.S. dollars.⁴

In addition, COMPUSTAT and *Value Line* have added some optional data. COMPUSTAT provides supplementary data for firms that have elected Financial Accounting Standard 96, *Accounting for Income Taxes*. Thus, a few firms have two sets of financial data. For the purposes of this study, the supplementary data has been eliminated from the analysis.⁵ *Value Line* occasionally reports duplicate identical financial information for a few firms using two different firm identification numbers. *Value Line*'s duplicate data, as well as their aggregate industry statistics, were also eliminated from the analysis.⁶

¹ The restatement policy is provided in section 4, page 4 of *COMPUSTAT II* (Standard and Poor's 1989). Revised data for merged firms prior to the ten-year summary are recorded as "not available."

² The restatement policy for *Value Line* can be found on page 1 of *The Value Line Datafile—A User's Manual* (Value Line Publishing 1992).

³ The authors uncovered the foreign currency reporting by *Value Line* through examination of financial reports.

⁴ Most data items in COMPUSTAT are represented in millions of dollars, rounded to the nearest thousand. Details are provided in section 8-A of *COMPUSTAT II* (Standard and Poor's 1989).

⁵ COMPUSTAT identifies firms with multiple listings by using "99Z" as the last digits in the company identification number (CUSIP). Companies with such multiple designations were eliminated from the analysis.

⁶ Unfortunately, the multiple listings in *Value Line* are not separately identified. The authors found six double listings for firms by visual inspection and eliminated one of each pair from further analysis.

Size Differentials

Both COMPUSTAT and *Value Line* traditionally follow the largest firms. Since *Value Line* has recently increased their firm coverage from approximately 1,600 firms to over 4,000, average firm size will have to be smaller.

Using the 1991 databases, no significant differences in the average size of firms on the two databases were observed up to 1985, although *Value Line* generally had higher averages across variables and through time. Beginning in 1985 when *Value Line* began its data series for new firms, the average size of firms in *Value Line* is significantly lower than that in COMPUSTAT.

For the relative distribution of the size of firms in the two databases, the bottom three quartiles of firms in *Value Line* were significantly larger (at the 0.01 level) than those in COMPUSTAT prior to 1985. Beginning in 1985, the firms in the COMPUSTAT database are significantly larger (at the 0.01 level) across all four quartiles. These results can have significant ramifications for those studies that investigate the effects of firm size.

Differences in Common Data Items for Same Firms

Many firms are common to both databases, which allows for direct comparisons of data items for the same firms. This additional control feature permits a more direct investigation of the effects of differing restatement or data assimilation policies.

Two common data items, sales and total assets, are used for direct comparison of the information in the databases. Sales⁷ and total assets are easily identifiable and are two of the less ambiguous financial accounting measures.

Table 1 displays the mean differences between identical data items matched by firm identification number, year and SIC code.⁸ The percentage of exact matches is shown as well as the percentage of data items that had immaterial differences. For the exact matches, a difference of \$10,000 (0.01 million) was allowed for rounding and computer storage differences. For the close matches, materiality was arbitrarily defined as five percent of the respective COMPUSTAT data item.

For total assets the mean difference in the data reported in the two databases is not statistically significant for any year between 1971 and 1990. For sales, however, there appears to be a problem in the reported data. Sales figures reported by COMPUSTAT are, on average, higher than those reported by *Value Line*. The mean difference increased over time and is significant at the 0.05 level from 1978 through 1987 and at the 0.01 level from 1988 through 1990.

Although there are often differences in reported data that are not statistically significant, the number of times the data items in the two databases exactly match or match without a material difference varies widely across data items. Exact matches for total assets (sales) range from a low of 69.8 (64.1) percent to a high of 80.8 (68.6) percent. Data with immaterial differences show total assets (sales) matching in 96.4 (91.0) to 99.1 (96.0) percent of the cases.

The years 1985 through 1990 were explored in more detail because they have the highest number of material differences in data items. Annual reports were examined to determine the source for the 137 and 378 material differences in reported total assets and sales, respectively. Table 2 displays the sources of these differences.

⁷ Both user manuals suggest that Sales/Revenues should represent net sales (gross sales less returns, discounts, and allowances).

⁸ The authors chose not to match by fiscal-year end (FYE) because of the different recording methods in each database (*Value Line* reports the exact date, and COMPUSTAT reports the month only) and the high number of missing FYEs (a relatively new variable) on *Value Line*. Mismatches on sales and total assets caused by differing FYEs are separately identified in table 2.

Table 1
Difference in Values of Variables for Firms Common to the 1991 Value Line and COMPUSTAT Databases

Year	Total Assets			Sales		
	Mean Difference ^c	Exact Matches (%) ^b	Close Matches (%) ^c	Mean Difference ^c	Exact Matches (%) ^b	Close Matches (%) ^c
1971	2.78	72.8	98.4	-0.15	68.5	96.0
1972	5.46	70.8	98.1	9.77	66.7	95.5
1973	3.34	73.2	99.1	10.25	67.5	95.5
1974	3.46	71.6	99.1	12.23	64.1	95.0
1975	2.85	74.7	99.1	13.44	65.5	95.7
1976	3.73	75.5	98.7	19.16	65.6	94.7
1977	4.53	74.7	97.9	29.51	66.7	93.5
1978	3.88	75.6	97.5	33.07*	64.7	93.6
1979	5.97	78.3	98.2	40.26*	65.0	94.7
1980	9.51	80.8	98.6	46.19*	66.6	94.8
1981	8.10	76.5	98.4	51.91*	64.1	94.3
1982	-18.93	75.0	97.9	48.26*	64.7	94.4
1983	-12.45	73.1	98.3	54.13*	68.6	94.6
1984	-12.60	73.4	97.6	73.00*	68.3	93.9
1985	-10.96	70.4	97.6	55.72*	67.6	93.3
1986	-5.59	69.8	96.7	64.77*	66.7	92.1
1987	13.37	70.7	96.4	69.58*	64.5	91.0
1988	13.41	71.8	97.3	87.87**	66.5	91.8
1989	11.90	70.2	96.8	99.75**	64.9	91.2
1990	15.66	74.3	97.6	91.88**	66.5	92.3

^aThe mean difference between the variable reported in COMPUSTAT less the same variable as reported in Value Line (in millions of dollars).

^bThe reported variable in COMPUSTAT was within \$10,000 of the same variable reported in Value Line.

^cThe difference between the reported variable in COMPUSTAT less the same variable in Value Line was within 5 percent of that reported in COMPUSTAT.

* Significant at the 0.05 level.

**Significant at the 0.01 level.

Table 2
Sources of Material Differences in Total Assets and Sales
for Firms Common to the 1991 COMPUSTAT and Value Line Databases

<i>Source of Difference for 1985-1990 Period</i>	<i>Total Assets</i>		<i>Sales</i>	
	<i>#</i>	<i>%</i>	<i>#</i>	<i>%</i>
<i>Value Line</i> reports data in foreign monetary units—COMPUSTAT uses US dollars	56	40.9	57	15.1
<i>Value Line</i> reports data as provided in the financial statements for that year—COMPUSTAT data do not match the financial statement data for that year, but				
a) COMPUSTAT data do match the restated data provided in 1990 financial statements	7	5.1	4	1.0
b) COMPUSTAT omits misc. income			29	7.7
c) COMPUSTAT has net (not all) revenues			11	2.9
d) COMPUSTAT reports only a portion of the lines of business			18	4.8
e) COMPUSTAT data also do not match the restated data provided in 1990 financial statements	41	29.9	15	4.0
f) reasons are unclear	4	5.1		
COMPUSTAT reports data as provided in the financial statements for that year— <i>Value Line</i> data do not match the financial statement data for that year because				
a) <i>Value Line</i> reports data for a subsidiary or parent	10	7.3	3	0.8
b) <i>Value Line</i> reports for certain lines of business			180	47.6
c) <i>Value Line</i> omits misc. income			37	9.8
d) <i>Value Line</i> has net (not all) revenues			3	0.8
e) <i>Value Line</i> has transposition error			1	0.3
f) <i>Value Line</i> reports pro forma data	2	1.5	2	0.5
g) reasons are unclear	4	2.9		
Entity is a trust—sales figure includes different income figures			4	1.0
Sales are small—differences in rounding causes a material difference			3	0.8
COMPUSTAT and <i>Value Line</i> select different fiscal year ends (when firm changes)	2	1.5	7	1.9
Neither COMPUSTAT nor <i>Value Line</i> 's data match the financial statements	2	1.5		
Miscellaneous	6	4.3	4	1.0
Total	137	100%	378	100%

The largest source of material differences for total assets and the second largest for sales was *Value Line*'s practice of reporting a foreign firm's financial data in its foreign currency. COMPUSTAT restates the data in U.S. dollars. This variation led to 40.9 (15.1) percent of the material differences in reported total assets (sales) during the period. In addition, both the number and reasons for material mismatches reveal more discretion in reporting sales data than in reporting total assets. The largest source of material differences in reported sales (47.6 percent) reflects this increased discretion because *Value Line* reported information for certain lines of business,⁹ while COMPUSTAT reported for the entire consolidated entity.¹⁰ For 29.9 percent of the firm-years, *Value Line*'s total assets matched those reported in that year's annual reports, but the COMPUSTAT data did not match either the data provided in the annual reports or restated data provided in subsequent annual reports by the firm. In an apparent conflict with the database's restatement policy, several cases were found (5.1 percent for total assets and 1 percent for sales) where the historical COMPUSTAT data matched the restated data subsequently provided by the firm. Other reasons are shown in table 2.

In summary, there are material differences between the average size of firms and the distribution of the size of firms in the COMPUSTAT and *Value Line* databases. Furthermore, in numerous instances material differences exist in the data that are compiled for each database for common variables for the same firm.

II. Database Incompatibilities and Empirical Inferences

Studies examining the relation between firm size and effective tax rates have led to differing conclusions. Zimmerman (1983), using the COMPUSTAT database, concluded that large firms have the highest effective tax rates. Conversely, Porcano (1986), using *Value Line* data, concluded that small firms have the highest effective tax rates. Several studies have attempted to reconcile these results (see Wilkie and Limberg 1990; Omer et al. 1991) on the basis of alternative sample selection techniques and variable definitions. Kern and Morris (1992) extended the reconciliation to include database differences and found opposite results in replicating the Porcano study when using COMPUSTAT rather than *Value Line* data.¹¹ Their results call for further investigation of the database issue.

Extending this line of research to include a control for the firms common to both databases is a necessary step in understanding the reasons for the incompatible results. If differences persist after controlling for firms common to both databases, then the disparities cannot be attributed to firm differences or firm size differentials; they are more likely to be caused by differences in the data assimilation policies of these databases.

To evaluate this issue, Porcano's study (1986) is replicated using each database, but only including firms that are common to COMPUSTAT and *Value Line*. Quartiles are generated by ranking firms common to the databases by sales. Figures 1 and 2 display the replication results using *Value Line* and COMPUSTAT, respectively. Although not identical, the pattern of effective tax rates using firms common to the databases is quite similar. The largest quartile has the lowest effective tax rates throughout the entire period. The similarity of the patterns in figures 1 and 2

⁹ *Value Line* input guidelines for "sales" state a preference for excluding other income. Emphasis is placed on items of a continuing nature and related to the company's major lines of business. Excluded revenue amounts are incorporated into other income fields to maintain financial statement articulation.

¹⁰ Over three-fourths of the material mismatches caused by *Value Line*'s reporting line-of-business data were in the insurance industry. Other industries for which *Value Line* reported only certain lines-of-business data were financial institutions, oil and gas, and real estate.

¹¹ For a summary of the incompatible results using the two databases, see figures 3 and 4 from Kern and Morris (1992).

suggests that much of the difference in the relation between effective tax rates and size observed by Kern and Morris (1992) is attributable to the different sample firms used from different databases.

Some differences still remain in the patterns of effective tax rates, however. Figure 1 (*Value Line*) results replicate Porcano's original findings, while figure 2 (COMPUSTAT) results show that the smallest quartile does not have the highest effective tax rate in 1983. In general, however, these figures reveal that even for the same set of firms, the effective tax rate measure tends to be higher for the *Value Line* database. For the firms common to both databases, column one of table 3 shows that the average annual effective tax rate measure using *Value Line* data was consistently higher than that using COMPUSTAT data, and the difference was significant (at the 0.05 level) in 12 of 14 years.

These differences in the level of effective tax rates are attributable to the different restatement or data assimilation policies of the databases. However, one can rule out differing reporting policies for foreign firms as a source of the differences because Porcano's study (and this replication) eliminated foreign firms from the sample.

Porcano's effective tax rate measure, however, contains many data items that are probably less familiar and are more ambiguous to users.¹² Of the 8,791 firm-year observations that are common to both databases between 1977 and 1990, only 3.1 percent of the effective tax measures are identical.¹³ Porcano's measure is based on five variables: current federal income taxes, income before extraordinary items, extraordinary items, minority interest, and equity in earnings of unconsolidated subsidiaries. As shown in table 3, much of the difference in the level of the effective tax rate measure is attributable to the current federal income taxes variable which possesses the lowest percentage of exact matches. *Value Line*'s representation of this variable is higher than COMPUSTAT's for 13 of the 14 years and is significantly higher (at the 0.05 level) for six of the 14 years for firms common to both databases. Income before extraordinary items also has a lower (though not significant) percentage of exact matches than either sales or total assets. Extraordinary items, minority interest, and equity in earnings of unconsolidated subsidiaries have higher percentages of exact matches than do sales or total assets. Despite having a higher percentage of exact matches, COMPUSTAT's measures of minority interest and equity in earnings of unconsolidated subsidiaries are on average significantly higher (at the 0.05 level) than *Value Line*'s in each year for the former and in a majority of years for the latter. Overall, the significant differences in the current federal tax and minority interest variables dominate the equity in earnings variable making *Value Line*'s effective tax rate measure higher than COMPUSTAT's.

¹² Porcano's effective tax rate measure is:

Current U.S. Federal Income Taxes
Adjusted Net Income Before Taxes

"Adjusted net income before taxes" is defined as net income before extraordinary items plus extraordinary items plus current federal income taxes plus minority interest less equity in unconsolidated subsidiaries. The data items are represented by the following COMPUSTAT (CP) data items and *Value Line* (VL) fields:

Current federal income taxes = CP Item #63 = VL Field #192

Income before extraordinary items = CP Item #18 = VL Field #28

Extraordinary items = CP Item #48 = VL Field #31

Minority interest (already included in the denominator for the *Value Line* database) = CP Item #49

Equity in earnings of unconsolidated subsidiaries = CP Item #55 = VL Field #18

Mean effective tax rates are weighted by adjusted net income before taxes.

¹³ To allow for rounding and to be consistent with tolerances for sales and total assets, the authors required the difference in effective tax rate measures to be within 0.01 percentage points.

Figure 1
Common Firms—Value Line Data

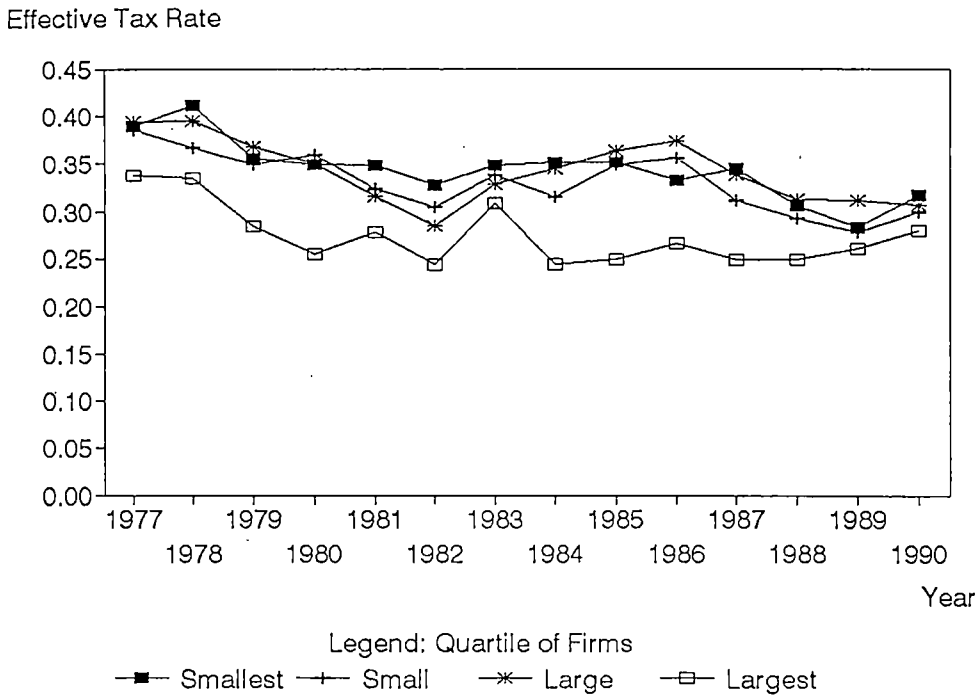


Figure 2
Common Firms—COMPUSTAT Data

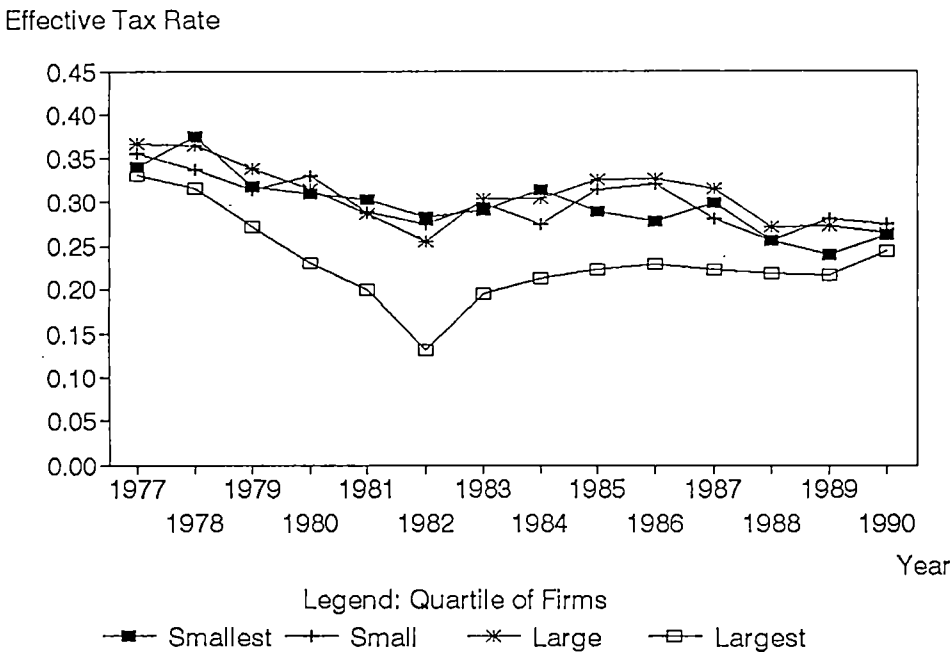


Table 3
Percentage of Exact Matches (Mean Differences) in the 1991 Databases
for Components of Porcano's Effective Tax Rate Measure

Effective Tax Rate Components						
Effective Tax Rate Measure	Current Federal Tax	Income Before Extraordinary Items	Extraordinary Items	Minority Interest	Equity in Earnings of Unconsolidated Subsidiaries	
1977	3.8 (-0.54)**	8.6 (0.53)	61.0 (5.84)	92.1 (-0.10)	82.7 (1.20)**	75.3 (2.33)
1978	4.1 (-0.40)**	6.4 (-1.17)	64.5 (5.79)	93.2 (-0.19)	85.5 (1.47)**	74.5 (2.38)*
1979	3.4 (-0.04)**	6.7 (-1.45)	66.8 (5.04)	93.1 (-0.34)	85.8 (1.87)**	74.5 (2.88)**
1980	3.6 (-0.08)**	7.3 (-5.11)**	68.9 (-0.24)	91.5 (-0.09)	85.8 (2.28)**	73.6 (4.78)*
1981	4.3 (-0.05)**	8.4 (-14.40)	66.0 (-0.02)	92.3 (0.03)	84.9 (2.44)**	75.8 (6.94)*
1982	4.5 (-0.04)**	7.9 (-15.23)	58.4 (-0.17)	80.6 (0.09)	86.1 (2.51)**	75.7 (4.86)*
1983	3.4 (-0.02)	5.4 (-23.37)	57.9 (4.07)	79.7 (-9.02)	87.9 (2.17)**	78.2 (4.00)*
1984	3.3 (-0.04)**	4.5 (-7.61)*	48.6 (-1.93)	74.2 (1.03)	87.2 (2.35)*	77.0 (3.57)

Continued

Table 3—Continued

	Effective Tax Rate Measure	Effective Tax Rate Components				Equity in Earnings of Unconsolidated Subsidiaries
		Current Federal Tax	Income Before Extraordinary Items	Extraordinary Items	Minority Interest	
1985	2.6 (-0.06)**	5.4 (-5.43)	50.4 (0.89)	75.6 (-1.22)	88.6 (2.29)*	77.9 (3.65)
1986	2.2 (-0.08)*	4.9 (-7.33)**	50.6 (-0.13)	73.1 (-0.25)	87.3 (2.56)**	78.1 (5.09)*
1987	1.8 (-0.03)**	5.2 (-5.61)	51.1 (-0.03)	72.7 (0.03)	87.4 (2.87)**	77.5 (3.99)
1988	2.6 (-0.05)**	4.9 (-7.00)*	53.2 (-1.05)	74.2 (1.25)	87.2 (3.61)**	78.9 (3.73)*
1989	3.0 (-0.52)**	5.5 (-8.20)**	52.6 (-4.06)	72.8 (4.34)	87.0 (4.25)**	80.0 (3.66)
1990	2.1 (-0.07)	3.8 (-6.95)**	54.2 (-1.90)	74.2 (2.52)	85.5 (4.45)**	80.4 (2.83)
Weighted Average	3.1 (-0.52)**	6.0 (-7.52)**	57.0 (0.16)	80.7 (0.08)	86.4 (2.69)**	77.2 (3.88)**

Note: The percentages represent the proportion of firms for which the difference between the measure computed from COMPUSTAT less the same measure from *Value Line* was within 0.01 percentage points for effective tax rate measures and within \$0.01 million for effective tax rate components.

The mean difference (shown in parentheses) is that between the measure computed from COMPUSTAT less the same measure from *Value Line*. Effective tax rates are denominated in percentages, components in millions.

* Significant at 0.05 level.

** Significant at 0.01 level.

III. Implications and Conclusions

This study has demonstrated the effect of database choice on the outcome of empirical research. An investigation of recent material disagreements between COMPUSTAT and *Value Line* for the variables total assets and sales reveals a large percentage of data items that did not match the financial statement data for the years 1985-1990. COMPUSTAT data matched more often with the variable sales while *Value Line* matched more often with total assets numbers. Some caveats need to be made, however. With the exception of line-of-business reporting for sales, *Value Line* generally provides the variable as reported on the financial statements. However, this figure will be in a foreign currency for foreign firms, and it may not conform to GAAP. COMPUSTAT's restatement policy for mergers and acquisitions, accounting changes, and discontinued operations allows one to examine the firms on an *as if* basis prior to the change.

This study demonstrates why analysts and researchers need to exercise great care when selecting databases and variables from those databases. These choices can affect the results of and the inferences drawn from empirical research in ways more than is anticipated by researchers.

References

- Kern, B. B., and M. M. Morris. 1992. Taxes and firm size: The effect of tax legislation during the 1980s. *Journal of the American Taxation Association* 14 (Spring): 80-96.
- Omer, T. C., K. H. Molloy, and D. A. Ziebart. 1991. Measurement of effective corporate tax rates using financial statement information. *Journal of the American Taxation Association* 12 (Spring): 68-75.
- Philbrick, D. R., and W. E. Ricks. 1991. Using Value Line and IBES analyst forecasts in accounting research. *Journal of Accounting Research* 29 (Autumn): 397-417.
- Porcano, T. M. 1986. Corporate tax rates: Progressive, proportional, or regressive. *Journal of the American Taxation Association* 8 (Spring): 17-31.
- Standard and Poor's COMPUSTAT Services. 1989. *COMPUSTAT II*. Englewood, CO: Standard and Poor's COMPUSTAT Services.
- Value Line Publishing. 1992. *Value Line Datafile—A User's Manual*. New York: Value Line Publishing.
- Wilkie, P. J., and S. T. Limberg. 1990. The relationship between firm size and effective tax rate: A reconciliation of Zimmerman (1983) and Porcano (1986). *Journal of the American Taxation Association* 11 (Spring): 76-91.
- Zimmerman, J. L. 1983. Taxes and firm size. *Journal of Accounting and Economics* 5 (2): 119-49.

Errors in Databases Revisited: An Examination of the CRSP Shares-Outstanding Data

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SYNOPSIS AND INTRODUCTION: This article considers errors in databases commonly used by researchers. Specifically, the study investigates the manner in which the Center for Research in Security Prices (CRSP) tapes adjusts prices for stock distributions, i.e., stock dividends and stock splits. All distributions reported by CRSP during the period January 1 through December 31, 1989 were reviewed for proper distribution code, record date, ex-dividend date, and distribution date by comparison to a secondary data source, *Moody's Dividend Record* (MDR). Additionally, the accuracy of the factor used by CRSP to adjust the price and number of shares outstanding for the stock distribution was verified by comparison to MDR. Completeness of CRSP reporting was tested by tracing all stock distributions reported by MDR back into the CRSP tapes. In all, 718 distributions were examined. All differences (142, or 20 percent of the distributions) were reconciled where possible (11 could not be resolved) by examination of the respective companies' annual reports. Coding differences (91, or 64 percent of the differences) arose because of CRSP policy of designating as stock dividends all distributions that are less than or equal to 20 percent of the then-existing shares while all others are stock splits. This coding policy may affect research that uses stock distributions to test signalling by management. The remaining 51 exceptions (36 percent) included 20 ex-date differences that were perceived to be of little consequence, and 31 dissimilarities (22 percent) that are considered significant. In 27 of these variances, CRSP was found to be in error, which ranged from 75 percent to 100 percent when compared to primary data sources.

In a second phase, the 1990 CRSP tape was examined to follow-up the status of 44 errors observed in the data review of previous work by these authors utilizing 1981 and 1982 data and of errors detected in phase one of this study. The evidence

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demonstrates that some errors remain undetected for long periods of time. Finally, the degree to which errors may affect the statistical testing of volume variables showed no significant bias.

Key Words: *Databases, Stock dividends, Stock splits, Trading volume.*

Data Availability: *All data used are available from sources identified in the text.*

THE remainder of this article is organized as follows: Section I provides the background and statement of the problem. Section II outlines the methodology utilized in the examination of the CRSP data and presents the results of the study. Section III contains the conclusions and addresses the implications for future research.

I. Background

Until recently, trading volume has been used sparingly in studies that seek to interpret or measure the effects of information on wealth transfers. Prior to 1987, few studies used volume as a dependent variable (see for example, Beaver (1968), Foster (1973), and Keller and Davidson (1983)); but recently researchers have had access to volume data through sources such as Data Resources, Inc. (DRI), the Media General Daily Price tape, Compu-Serve, and the CRSP tape.

The recent increase in the use of volume analyses in empirical research (Bamber 1986; Courtenay et al. 1989; Ajinkya and Jain 1989; Ajinkya et al. 1991) may be attributed in part to the availability of the data. Furthermore, the use of volume may provide the user with a metric that clarifies market consensus when considered concomitantly with price changes. Since researchers are relying on machine-readable data rather than using original documents, the quality of volume research would depend on the quality of machine-readable data.

Previous studies have addressed the errors in databases such as the CRSP and COMPUSTAT tapes. Rosenberg and Houglet (1974) dealt with price relative errors in the CRSP and COMPUSTAT databases and San Miguel (1977) tested the reliability of research and development cost data in the COMPUSTAT database. Rosenberg and Houglet found 34 errors in the CRSP/COMPUSTAT data of monthly price relatives that were more than five percent per month. Four of these errors came from the CRSP data and were the result of incorrect adjustments for stock splits. The level of errors found in the two databases led the authors to recommend comparing observations from different databases or verifying their accuracy against other sources. At minimum, outliers should be investigated for correctness. Similarly, Grinblatt et al. (1984, 465) reported discrepancies in adjustments resulting from stock splits and dividends similar to the errors reported by Rosenberg and Houglet (1974).

Rosenberg and Houglet (1974, 1303) state that the CRSP tape is "justly reputed to be of high quality." To our knowledge, there have been no other reports of unsatisfactory price change data, although Dyckman and Morse mention the possibility of substantial error levels in databases in their 1975 book, but not in their 1985 edition.

In the data review of an earlier study (Courtenay et al. 1989), several errors were found while checking the data used in the determination of the ratio of shares traded to shares outstanding on a given day. Shares traded data, purchased from DRI, and shares-outstanding data, obtained from the CRSP tape were checked against *Standard & Poor's Daily Stock Price Record*. The review encompassed examination of the shares-outstanding data for 377 companies over respective 75-day periods in 1981 and 1982. The data purchased from DRI were found to be free of errors, but several errors were found in the shares-outstanding data obtained from the CRSP tape. A total of

44 errors were detected. Approximately 80 percent of these errors could be attributed to either incorrect or missing adjustments for stock splits and stock dividends, as in Rosenberg and Houglet (1974) and Grinblatt et al. (1984).

II. Methodology and Results

We examined all distributions reported by CRSP as a stock dividend or stock split during the calendar year 1989. CRSP reporting was verified against MDR by checking the distribution code, the record date, the ex-dividend date, and the distribution date. Also, the accuracy of the adjustment factor used by CRSP was compared to the distribution reported in MDR. All stock dividends and splits reported by MDR during 1989 were investigated to ensure that they were properly included in the tape. Differences were reconciled by reviews of annual reports. To determine the persistence of errors over time, errors discovered on the 1981 and 1982 tapes, and on the 1989 tape were traced into the 1990 CRSP tape.

The extent to which errors affect and bias the results of statistical testing is the final step in the analysis. CRSP procedure for updating shares-outstanding data allows an error to persist in the data for up to ninety days for companies that report quarterly, and up to one year for companies reporting annually. Since the opportunity for error persistence is much greater in the shares-outstanding data, this part of the analysis was confined to the potential bias of errors upon statistical testing of volume variables.

The examination of stock dividends and splits reported by CRSP for the New York (NYSE) and the American (ASE) Stock Exchanges and various Over-The-Counter (OTC, NASDAQ) exchanges encompasses 718 observations including 12 distributions that were not included in MDR. Discrepancies included 91 coding differences, 20 ex-date differences, eight instances of late updates, five occurrences of arithmetic errors, one case in which an option dividend was improperly treated as a stock dividend instead of a cash dividend, and 17 reporting differences between CRSP and MDR.

Coding differences arose when CRSP reports a distribution as a stock dividend but MDR reports it as a stock split or vice versa. Where possible, these discrepancies were resolved by a review of annual reports. Eleven instances of coding variations could not be resolved due to unavailability of annual reports or due to merger or reorganization. The remaining 80 differences were all resolved. In 13 situations the CRSP coding was incorrect, three cases where CRSP coding was correct, and 64 instances where CRSP coding indicates a stock split when the distributions were described as split-up of shares effected as stock dividends. Many of the coding differences appear to arise from the manner in which CRSP designates a stock distribution as a stock dividend or a split. For CRSP, a distribution less than 20 percent of the outstanding shares is a stock dividend, otherwise it is a stock split. MDR follows the annual report's designation.

Although an examination of each stock split or dividend's record date, ex-date, and distribution date was made, the ex-date differences were deemed to be of interest because CRSP adjusts both price and share information on that date to reflect the distribution. The ex-dates reported by CRSP and MDR were in conflict in 20 cases. Ninety percent of the differences involved OTC companies, 95 percent were of a duration of one day, and 95 percent were reported earlier by MDR than by CRSP. Since MDR is a secondary source of information concerning stock distributions, *The Wall Street Journal Index* and *Standard & Poor's Quarterly Dividend Record* were reviewed to determine whether CRSP or MDR had accurately reported the ex-date. Eighteen occurrences were included in *The Wall Street Journal Index*, with which all other sources agreed. CRSP was in agreement with the *Standard & Poor's Quarterly Dividend Record* on one discrepancy, and there was no agreement between the sources on the remaining difference. Ex-date differences do not appear to be a serious problem.

Table 1
Summary of 1989 CRSP Errors

<i>Magnitude*</i>	<i>Exchange</i>		<i>Status on 1990 Tape</i>		
	<i>NYSE & ASE</i>	<i>NASDAQ</i>	<i>R</i>	<i>N</i>	<i>N/A</i>
Late Update					
$0 < \% \leq 10$	—	2	—	2	—
$10 < \% \leq 20$	2	—	1	1	—
$20 < \% \leq 50$	—	1	1	—	—
$50 < \% \leq 100$	$\frac{3}{5}$	$\frac{—}{3}$	$\frac{3}{5}$	$\frac{—}{3}$	$\frac{—}{—}$
Arithmetic					
$0 < \% \leq 10$	3	1	1	3	—
$10 < \% \leq 75$	$\frac{—}{3}$	$\frac{1}{2}$	$\frac{—}{1}$	$\frac{1}{4}$	$\frac{—}{—}$
Other					
$0 < \% \leq 10$	$\frac{1^{**}}{1}$	$\frac{—}{—}$	$\frac{—}{—}$	$\frac{1}{1}$	$\frac{—}{—}$

* Absolute value of percentage of shares outstanding.

** Option dividend treated as a stock dividend rather than a cash dividend.

R = restated;

N = not restated; and

N/A = not on tape.

Table 1 summarizes 14 late updates and arithmetic errors. The late update may be as much as a full quarter, or longer if only annual information is published. The eight late updates detected fell within one quarter. These errors ranged in size from a five-percent stock dividend to a two-for-one split, and went uncorrected for up to 90 days.

There were five occurrences of arithmetic errors. These errors caused differences in shares outstanding ranging from 5,000 to 3,035,000 and were not detected for at least three months. Neither late updates nor arithmetic errors appear to be grouped by exchange. By 1990, eight of these errors had not been discovered, and three other errors were not fully restated as the factors to adjust prices and shares did not accompany the restatement.

Panel A of table 2 details the 12 observations of distributions reported in CRSP but not in MDR. Eight of the distributions reported by CRSP could not be substantiated from annual reports. In five cases, CRSP changed the number of shares outstanding as if the company had a reverse stock split when the company had reduced the number of shares outstanding due to quasi-reorganization, corporate restructuring, or bankruptcy proceedings. No corroborating information could be found on the other three instances where CRSP indicates a stock distribution. However, four distributions were correctly reported in CRSP but not in MDR. These types of

Table 2
Comparison of Distribution Reporting by CRSP and MDR

Panel A. Distributions Reported by CRSP, but not by MDR:

Exchange	Total	MDR Correct	CRSP Correct	Status on 1990 Tape		
				R	N	N/A
NYSE & ASE	5	4	1	2	1	1
NASDAQ	$\frac{7}{12}$	$\frac{4}{8}$	$\frac{3}{4}$	$\frac{-}{2}$	$\frac{4}{5}$	$\frac{-}{1}$

Panel B. Distributions Reported by MDR, but not by CRSP:

Exchange	Total	MDR Correct	CRSP Correct	Status on 1990 Tape		
				R	N	N/A
NYSE & ASE	—	—	—	—	—	—
NASDAQ	$\frac{5^*}{5}$	$\frac{4}{4}$	$\frac{-}{-}$	$\frac{2}{2}$	$\frac{3}{3}$	$\frac{-}{-}$

* One distribution was incorrectly reported as a 1-for-5 instead of a 1-for-50 reverse split.

R = restated;

N = not restated; and

N/A = not on tape.

discrepancies do not appear to be clustered by exchange. Five of the eight instances were not corrected on the 1990 tape. Of the two errors that were detected, one was not fully restated because the factor to adjust price and shares was omitted. Panel B of table 2 details the distributions reported in MDR but not in CRSP, in which MDR is consistent with annual reports. However, in one instance, MDR published a one-for-five reverse split when the annual report shows that the company underwent a one-for-fifty reverse stock split.

Table 3 summarizes the results of checking the 1990 tape for correction and retroactive restatement of the 44 errors discovered in 1981-82. These errors are related to late updates for stock splits/dividends or misstatement of the number of shares outstanding. Thirty-six of these errors were retroactively restated on the 1990 tape. Twenty-seven of the restatements properly adjusted the number of shares with a code indicating a change in shares due to a stock distribution.

The final part of the analysis investigated the extent to which errors may affect and bias statistical testing. In a previous study the authors found no significant differences in the test results on volume data after correcting the detected errors. The tests were reperformed on 205 companies with 75 daily volume observations. Volume variables for 17 of these companies were in error for periods varying from three to 73 days. The size of these errors ranged from three to 500 percent of the then outstanding shares.

Table 3
Status of 1981 and 1982 Errors on 1990 CRSP Tape

<i>Error Type</i>	<i>Total</i>	<i>R</i>	<i>N</i>	<i>N/A</i>	<i>Not Comparable*</i>
1981					
Late Update	28	27	—	1	—
Arithmetic	$\frac{5}{33}$	$\frac{3}{30}$	$\frac{1}{1}$	$\frac{—}{1}$	$\frac{1}{1}$
1982					
Late Update	7	6	—	1	—
Arithmetic	$\frac{4}{11}$	$\frac{—}{6}$	$\frac{3}{3}$	$\frac{1}{2}$	$\frac{—}{—}$

* Change in company through reorganization, restructure or merger.

R = restated;

N = not restated; and

N/A = not on tape.

III. Conclusions

Analysis of CRSP data tape for 1989 suggests a high degree of reporting accuracy in connection with stock distribution information. The analysis compared CRSP against other secondary sources of data as well as annual reports. The results were corroborated by further investigations. Based on the analysis, the probability of randomly selecting a company reporting a stock distribution improperly administered by CRSP in 1989 is approximately three percent. The probability of this type of error affecting research using price relatives is remote. However, the persistence of the errors over time increases the possibility of affecting a trading volume study.

References

- Ajinkya, B. B., R. K. Atiase, and M. J. Gift. 1991. Volume of trading and the dispersion in financial analysts' earnings forecasts. *The Accounting Review* 66 (April): 389-401.
- _____, and P. Jain. 1989. The behavior of daily stock market trading volume. *Journal of Accounting and Economics* 11 (November): 331-59.
- Bamber, L. S. 1986. The information content of annual earning releases: A trading volume approach. *Journal of Accounting Research* 24 (Spring): 40-56.
- Beaver, W. 1968. The information content of annual earnings announcements. *Journal of Accounting Research* 6 (Supplement): 67-92.
- Courtenay, S. M., R. P. Crum, and S. B. Keller. 1989. Differential reactions to legislative signaling during the enactment of ERTA and TEFRA: An empirical investigation of market returns and volume. *The Journal of Accounting and Public Policy* 8 (Winter): 283-321.
- Dyckman, T., and D. Morse. 1985. *Efficient Capital Markets and Accounting: A Critical Analysis*. 2d ed. Englewood Cliffs, NJ: Prentice-Hall.
- Foster, G. 1973. Stock market reaction to estimates of earnings per share. *Journal of Accounting Research* 11 (Spring): 25-37.

- Grinblatt, M. S., R. W. Masulis, and S. Titman. 1984. The valuation effects of stock splits and stock dividends. *Journal of Financial Economics* 13 (December): 461-90.
- Keller, S. B., and L. F. Davidson. 1983. An assessment of individual investor reaction to certain qualified audit opinions. *Auditing: A Journal of Practice & Theory* 3 (Fall): 1-22.
- Rosenberg, B., and M. Houglet. 1974. Error rates in CRSP and COMPUSTAT databases and their implications. *The Journal of Finance* 29 (September): 1303-10.
- San Miguel, J. G. 1977. The reliability of R&D data in COMPUSTAT and 10-K reports. *The Accounting Review* 52 (July): 638-41.

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Charge: 1. To identify and implement means to accomplish a needs assessment in the areas of faculty and curriculum development.

2. To provide oversight and direction for those who implement the needs assessment effort.

3. To develop a Strategic Plan based on all available information, including the needs assessment, for the American Accounting Association's efforts in the areas of faculty and curriculum development.

4. To recommend alternative courses of action to the Executive Committee including value-added assessments, organizational structure and budget implications.

Chairperson: Gary Sundem, University of Washington

Andrew D. Bailey, Jr., University of Arizona

Russell Barefield, University of Georgia

Larry Scott, Price Waterhouse

Jay Smith, Brigham Young University

Jerry J. Weygandt, University of Wisconsin

Jan R. Williams, University of Tennessee

Jean Wyer, Coopers & Lybrand

STANDING COMMITTEE FINANCE COMMITTEE

Charge: 1. To prepare financial goals and strategies for the Association.
 2. To evaluate additional or alternative ways to finance existing Association activities.
 3. To work with the 1993-1994 President-Elect in preparing the 1994-1995 budget.
 4. To recommend how AAA funds should be invested in accordance with established Executive Committee policies and procedures.

Chairperson: Bernard J. Milano, KPMG Peat
 Marwick
 Steve W. Albrecht, Brigham Young University
 Mary Stone, University of Alabama

Jane O. Burns, Texas Tech University
 Anita Hollander, Florida State University
 Carl Warren, University of Georgia

STANDING COMMITTEE FINANCIAL ACCOUNTING STANDARDS COMMITTEE

Charge: 1. To evaluate selected discussion memoranda and exposure drafts related to financial accounting and reporting in the private sector as they are released by the FASB and to respond to the FASB in writing and by appearing at selected public hearings.

2. To be cognizant of emerging issues related to financial accounting and reporting in the private sector through materials issued by the Emerging Issues Task Force and other relevant sources with evaluation, where appropriate, of the significance and potential implications of such issues.

3. To meet with the FASB, normally on an annual basis.

4. To explore the publication of selected responses by the committee in *Accounting Horizons* or other appropriate outlets.

5. To consider and promote ways to increase the academic input to the standard-setting process.

6. To provide input to the Financial Reporting Issues Conference Committee on the appropriate content and structure of the 1994 conference.

Chairperson: Mary E. Barth, Harvard University
 Tim Bell, KPMG Peat Marwick
 Daniel W. Collins, University of Iowa
 Michael Crooch, Arthur Andersen & Co.
 John A. Elliott, Cornell University

Thomas J. Frecka, University of Notre Dame
 Eugene A. Imhoff, Jr., University of Michigan
 Wayne R. Landsman, University of North
 Carolina
 Ray G. Stephens, Kent State University

FINANCIAL REPORTING ISSUES CONFERENCE COMMITTEE

Charge: 1. To plan the 1994 Financial Reporting Issues Conference in accordance with established AAA policies.

2. To seek the advice of the Financial Accounting Standards Committee on the content and structure of the 1994 conference.

3. To arrange to have the conference conducted and administered.

4. To report on the results and effectiveness of the conference and to recommend changes by November 1, 1994.

Chairperson: Lawrence Revsine, Northwestern
 University
 Thomas Dyckman, Cornell University
 Robert Elliott, KPMG Peat Marwick

Todd Johnson, Financial Accounting Standards
 Board
 Barry Lewis, University of Colorado at Boulder
 Krishna G. Palepu, Harvard University

INNOVATION IN ACCOUNTING EDUCATION AWARD COMMITTEE

Charge: 1. To select recipient(s) of the Outstanding Teaching/ Curriculum Development Award using the criteria approved by the Executive Committee.

2. To evaluate establishing a list of highly ranked nominees for passing on to the next committee.
3. To reconsider the future of this award.

Chairperson: Jay Smith, Brigham Young University
 Richard E. Baker, Northern Illinois University
 Bruce Baldwin, Arizona State University-West Campus

Ralph L. Benke, Jr., James Madison University
 Rob Bricker, Case Western Reserve University
 Brent Inman, Coopers & Lybrand
 Jacky Sanders, Mercer County Community College

INTERNATIONAL FACULTY EXCHANGE COMMITTEE

Charge: 1. To select the professors to be involved in the program for the 1995 tour (Russia and Baltic countries for a U.S./Canadian lecturer). To select schools in the United States and Canada for the 1994 lecture tour. To select the area for the 1996 visit.

2. To assist the Executive Director with announcements, arrangements, and follow-up evaluations for the respective visits.

3. To review the criteria for selection and to prepare a proposal for consideration by the Executive Committee.

Chairperson: Belverd E. Needles, Jr., DePaul University
 Frederick D. S. Choi, New York University
 Adolf J. H. Enthoven, University of Texas at Dallas
 Richard Flaherty, Arizona State University
 Paul Gerhardt, American Accounting Association

Sidney Gray, The University of Warwick Coventry
 Jevons Lee, The Hong Kong University of Science & Technology
 Charles H. Smith, Penn State University
 Murray Wells, University of Sydney

LITIGATION COMMITTEE

Charge: 1. To investigate the existing literature bearing on litigation in the professions and to prepare a review of this literature with special emphasis on the implications for accounting practice, research, and teaching. (Some form of publication outlet might be proposed for this effort.)

2. To work with the public accounting and industry groups (e.g., AICPA, FEI, NAA, IIA, CEASE) who have expressed an interest in this issue with a view toward obtaining information in support of academic research and teaching, e.g., access to data in support of potential research efforts or teaching case development, appropriate future liaison relationships. (Access to data may require the development of a policy recommendation for AAA membership in approaching firms for data. Note that the Auditing Section has a committee looking into a similar matter of subject use for the creation of data. Perhaps this committee should contact the chair of the Auditing Section committee.)

3. To recommend to the AAA Executive Council any policy positions that seem appropriate given existing research and practice information. (For example, should the AAA Executive Council actively support litigation reform of some nature?)

Chairperson: William R. Kinney, University of Texas at Austin
 John W. Hill, Indiana University
 Richard W. Leftwich, University of Chicago
 Zoe-Vonna Palmrose, University of Southern California

Katherine Schipper, University of Chicago
 John Siliciano, Cornell Law School
 Norman Walker, Price Waterhouse

MEMBERSHIP AND SUBSCRIPTIONS COMMITTEE

- Charge:* 1. To increase the quantity and quality of the membership of the Association.
 2. To increase the quantity of the subscriptions to all Association journals.
 3. To develop a strategy for communicating benefits of AAA membership to two-year college faculty.

Co-Chairpersons: Katy Stice, Rice University
 Lorraine Hicks, State Technical Institute at Memphis
 Joseph Y. Abekah, University of New Brunswick
 Sunita S. Ahlawat, University of Illinois at Chicago
 Sam Asamoah, Jefferson Community College
 George Battistel, University of Manitoba
 Paul L. Bowen, Auburn University
 Michael E. Bradbury, University of Auckland
 Anthony Chan, City Polytech of Hong Kong
 Chak-Tong Chau, University of Texas at San Antonio
 Charles J. Coate, University of Kansas
 Gary J. Colbert, University of Kentucky
 David Cottrell, Brigham Young University
 Francie Criner, University of Maine-University College
 Thomas M. Dalton, University of San Diego
 Elizabeth B. Davis, Baylor University
 Patricia Dechow, University of Pennsylvania
 Leslie G. Eldenburg, California State University-Fresno
 Neil Fargher, University of Oregon
 N. Allen Ford, University of Kansas
 David R. Fordham, James Madison University
 Peter J. Frischmann, University of Wisconsin-Madison
 Sonja Gallhofer, University of Essex
 Helen Gerard, Miami University
 Hubert D. Glover, Clemson University
 Jayne M. Godfrey, University of Queensland
 Thomas L. C. M. Groot, University of Limburg
 David A. Guenther, University of Connecticut
 Flora Guidry, University of New Hampshire
 Charles Harter, University of Alaska-Fairbanks
 Eric N. Johnson, University of Wyoming
 Marilyn F. Johnson, University of Michigan
 Gregory Kane, University of Delaware
 Jennifer L. Kao, University of Waterloo
 Paul M. Kazenski, University of Hawaii at Manoa
 David P. Kirch, Kent State University
 Leon Korte, University of South Dakota
 Joseph Kreutle, Miami Dade Community College

Janice E. Lawrence, University of Nebraska
 Linda Lessing, SUNY-College of Technology at Delhi
 Tim M. Lindquist, University of Northern Iowa
 May H. Lo, University of Colorado at Denver
 Mary J. Loyland, University of North Dakota
 William H. Lucas, University of Southern Mississippi
 Joan L. Luft, Michigan State University
 R. Lorraine McClenny, North Carolina State University
 Carlos Mello-e-Souza, Penn State University
 Cindy L. Moeckel, Arizona State University
 Yasuhiro Monden, University of Tsukuba
 Kathleen Mooney, St. Cloud University
 Robert A. Nehmer, Georgia State University
 Terrence O'Keefe, University of Oregon
 Don Pagach, Louisiana State University
 Timothy A. Pearson, West Virginia University
 Barbara G. Pierce, Florida Atlantic University
 Jeffrey Power, University of Rhode Island
 T. Flemming Ruud, Norwegian School of Economics & Business
 Robert Sarikas, Boise State University
 Marsha A. Scheidt, University of Tennessee at Chattanooga
 Joseph J. Schultz, Arizona State University
 Ananth Seetharaman, St. Louis University
 Keith F. Sellers, University of Arkansas
 Katherine J. Silvester, Rensselaer Poly Institute
 Praveen Sinha, SUNY at Buffalo
 Randal H. Stitts, Sul Ross State University
 Morris Stocks, University of Mississippi
 Ellen Sweatt, DeKalb College
 Beverly Terry, Central Piedmont Community College
 Chris J. Trunkfield, British Columbia Institute of Technology
 Janet M. Vreeland, University of Nevada, Reno
 Peter J. Walton, London School of Economics
 Edwards J. Watts, Macquarie University
 Susan G. Watts, Indiana University
 Jane Wiese, Valencia Community College
 Anne Wu, National Chengchi University
 Dan Zarycki, Hillsborough Community College

MINORITY FACULTY DEVELOPMENT COMMITTEE

- Charge:* 1. To explore ways in which potential minority candidates can be encouraged to apply to accounting doctoral programs and to pursue professional careers in accounting education.
 2. To explore ways in which to encourage the development of minority faculty members.
 3. To examine and monitor minority recruitment programs of other professional organizations, such as the AICPA.
 4. To develop a strategic plan for the American Accounting Association in the area of Minority Faculty Development.

Chairperson: Willie E. Gist, University of Oklahoma
 James J. Benjamin, Texas A&M University
 Barney Cargile, University of Alabama
 Barry F. Doll, Price Waterhouse

Rameshwar D. Gupta, Jackson State University
 Theresa A. Hammond, Boston College
 Priscilla Slade, Texas Southern University
 T. Sterling Wetzel, Oklahoma State University

NEW FACULTY CONSORTIUM COMMITTEE

Charge: 1. To plan the 1994 New Faculty Consortium in accordance with established AAA policies.
 2. To arrange to have the consortium conducted and administered.
 3. To report on the results and effectiveness of the consortium and to recommend changes by March 1, 1994.

Chairperson: Silvia Madeo, University of Missouri-St. Louis
 Bud Baskin, Arthur Andersen & Co.
 Robert Holthausen, University of Pennsylvania
 Jane Mutchler, Penn State University

Judy Rayburn, University of Minnesota
 Dennis Reigle, Arthur Andersen & Co.
 S. Mark Young, University of Southern California

STANDING COMMITTEE NOMINATING COMMITTEE

Charge: 1. To select a list of nominees to AAA offices for election by the membership in August 1994.
 2. To prepare a report for publication in ACCOUNTING EDUCATION NEWS describing the process followed in arriving at the nominations made by the committee.

Chairperson: Alvin A. Arens, Michigan State University
 Anita Hollander, Florida State University
 Morley Lemon, University of Waterloo

Corine Norgaard, SUNY-Binghamton
 Gary Sundem, University of Washington
 G. Peter Wilson, Harvard University
 Arthur Wyatt, University of Illinois

NOTABLE CONTRIBUTIONS TO ACCOUNTING LITERATURE AWARD SCREENING COMMITTEE

Charge: To identify works of exceptional merit from published accounting books and articles that meet the guidelines for the "Notable Contributions" awards established by the Executive Committee.

Chairperson: Ella Mae Matsumura, University of Wisconsin-Madison
 David H. Abramson, Grant Thornton
 Steven K. Asare, University of Florida
 Frances L. Ayres, University of Oklahoma
 Bala V. Balachandran, Northwestern University
 Tim Bell, KPMG Peat Marwick
 Chee W. Chow, San Diego State University
 Andrew A. Christie, University of Rochester
 C. Bryan Cloyd, University of Texas at Austin
 Linda E. DeAngelo, University of Southern California
 John W. Dickhaut, University of Minnesota
 Haim Falk, McMaster University
 Joseph G. Fisher, Dartmouth College
 Micah P. Frankel, California State University, Hayward
 James R. Frederickson, Indiana University
 Bruce R. Gaumnitz, University of Cincinnati
 Michael Gibbins, University of Alberta
 Frank B. Gigler, University of Chicago
 Sharon Green, Duquesne University

Penelope S. Greenberg, Temple University
 Karl Hackenbrack, University of Florida
 Frank Heflin, University of Wisconsin-Madison
 Edward J. Joyce, University of Minnesota
 Wayne R. Landsman, University of North Carolina
 Kyung T. Lee, Pennsylvania State University
 Robert A. Leitch, University of South Carolina
 John C. Lere, Saint Cloud State University
 John D. Lyon, University of California-Davis
 Daphne Main, University of New Orleans
 Steve Matsunaga, University of Oregon
 Kenneth J. Moores, Bond University
 Mark Nelson, Cornell University
 Eric W. Noreen, University of Washington
 James A. Ohlson, Columbia University
 Gary John Previts, Case Western Reserve University
 Frank Rayburn, University of Alabama at Birmingham
 David Ricchiute, University of Notre Dame
 Alan Roshwalb, Georgetown University

Jeffrey W. Schatzberg, University of Arizona
 Dan A. Simunic, University of British Columbia
 Richard G. Sloan, University of Pennsylvania
 Miklos A. Vasarhelyi, Rutgers University–
 Newark

Robert L. Vigeland, Texas Christian University
 Dewey D. Ward, Michigan State University
 Arnold M. Wright, Northeastern University

NOTABLE CONTRIBUTION TO ACCOUNTING LITERATURE AWARD SELECTION COMMITTEE [JOINT COMMITTEE WITH THE AICPA]

Charge: To select the recipient(s) of the award from those books and articles identified by the Screening Committee as potentially notable accounting literature contributions.

Chairperson: Wanda Wallace, College of
 William and Mary
 Stanley Baiman, Carnegie Mellon University
 Stanley F. Biggs, University of Connecticut

Nicholas Dopuch, Washington University
 William Scott, University of Waterloo
 Frank H. Selto, University of Colorado at Boulder

OUTSTANDING ACCOUNTING EDUCATOR AWARD COMMITTEE

Charge: To select one or, at most, two recipients of the Outstanding Educator Award using the criteria approved by the Executive Committee.

Chairperson: Dan Smith, University of Georgia
 Efrim Boritz, University of Waterloo
 Gyan Chandra, Miami University
 Anna C. Fowler, University of Texas at Austin

Paul Healy, Massachusetts Institute of
 Technology
 Yuji Ijiri, Carnegie Mellon University
 Lawrence Tomassini, University of Illinois

PROFESSIONAL EXAMINATIONS COMMITTEE

Charge: 1. To monitor activities of the AICPA and NASBA and evaluate the implications for the CPA examination and accounting education.

2. To monitor activities of the IIA, IMA, NACFE and evaluate the implications of their respective examinations on accounting education.

3. To identify activities the Association should consider undertaking that deal with the effect of professional examinations on accounting education.

4. To coordinate all activities and recommendations with the Accounting Education Advisory Committee.

Chairperson: Larry Rittenberg, University of
 Wisconsin
 Joyce S. Allen, Xavier University
 Richard Asebrook, University of Massachusetts
 James Blum, American Institute of CPAs

Pamela J. Erickson, Vanderbilt University
 Gary Fish, Illinois State University
 Keith Lantz, California State University–
 Fullerton
 Thomas Powell, Institute of Internal Auditors

PROFESSIONALISM AND ETHICS SEMINAR COMMITTEE

Charge: 1. To plan the 1994 Professionalism and Ethics Seminar in accordance with established AAA policies.

2. To arrange to have the seminar conducted and administered.

3. To continue the development of suitable educational materials related to professionalism and ethics.

4. To report on the results and effectiveness of the seminar and to recommend changes by July 1, 1994.

Chairperson: James C. Gaa, McMaster
 University
 Mary S. Doucet, North Carolina A&T State
 University

Kenneth Euske, Naval Postgraduate School
 Gary Fish, Illinois State University
 Rayman Meservy, Brigham Young University

Frederick Neumann, University of Illinois
Larry Poneman, Babson College

Robert Ramsay, Georgia Institute of Technology
Robert G. Ruland, Suffolk University

PROFESSIONAL PRACTICE QUALITY COMMITTEE

Charge: 1. To prepare a list of potential practice quality issues that the AAA membership might contribute to resolving or better understanding.

2. To investigate one or more of the issues identified by: a. surveying the existing literature bearing on the issue and preparing a review of this literature with special emphasis on the implications for accounting practice, research, and teaching. (Some form of publication outlet might be proposed for this effort.)

b. To work with the public accounting and industry groups (e.g., AICPA, FEI, NAA, IIA, CEASE) who have expressed an interest in this issue with a view toward obtaining information in support of academic research and teaching, e.g., access to data in support of potential research efforts or teaching case development. (Access to data may require the development of a policy recommendation for AAA membership in approaching firms for data. Note that the Auditing Section has a committee looking into a similar matter of subject use for the creation of data. Perhaps this committee should contact the chair of the Auditing Section committee.)

3. To recommend to the AAA Executive Council any policy positions that seem appropriate given existing research and practice information.

Chairperson: William Felix, University of Arizona.
Alvin Arens, Michigan State University
James Jambalvo, University of Washington

Bruce Johnson, University of Iowa
Abbie Smith, University of Chicago
Arthur Wyatt, University of Illinois

PROGRAM ADVISORY COMMITTEE

Charge: To assist the President and Executive Director in developing the technical program for the 1994 Annual Meeting.

Chairperson: William R. Kinney, Jr., University of Texas at Austin
Vice-chairperson-Education: G. Peter Wilson, Harvard University
Vice-chairperson-Research: Senyo Y. Tse, University of Texas at Austin
Jeffrey Abarbanell, University of Michigan
Linda Bamber, University of Georgia
Sarah Bonner, University of Southern California
John Chandler, University of Illinois-Champaign
Chee Chow, San Diego State University
Dan Dhaliwal, University of Georgia
Ron Dye, Northwestern University
Robert N. Freeman, University of Texas-Austin
Ron King, Washington University
April Klein, New York University
Lisa Koonce, University of Texas-Austin
Jim Noel, University of Michigan
Krishna Palepu, Harvard University
Ron Rasch, Auburn University
John Robinson, University of Texas at Austin
Richard Sansing, Yale University
Charles Swenson, University of Southern California
Jacob Thomas, Columbia University
John Wild, University of Wisconsin
Arnie Wright, Boston College
Vice-chairperson-Sections: Shane Moriarity, University of Oklahoma

Accounting, Behavior and Organizations-Paul Munter, University of Miami
Administrators of Accounting Programs-Jerry E. Trapnell, Clemson University
American Taxation Association-Mark Higgins, University of Rhode Island
Artificial Intelligence/Expert Systems-Daniel E. O'Leary, University of Southern California
Auditing-Mohammad Abdolmohammadi, Bentley College
Financial Accounting and Reporting-John A. Elliott, Cornell University
Gender Issues in Accounting-Paula Thomas, Middle-Tennessee State University
Government and Nonprofit-Marc Rubin, Miami University
Information Systems/MAS-Dan Stone, University of Illinois
Information Systems/MAS-Martha Eining, University of Utah
International Accounting-Mark Lang, Stanford University
Management Accounting-Sue Haka, Michigan State University
Teaching and Curriculum-David E. Stout, Villanova University
Two-Year College-Ellen Sweatt, DeKalb College (North)

STANDING COMMITTEE PUBLICATIONS COMMITTEE

- Charge:* 1. To monitor all aspects of the Association's publication program.
 2. To report periodically to the President and Executive Committee on all matters of concern in the field of publications.
 3. To recommend candidates for editor or editor-elect positions as appropriate.
 4. To recommend AAA publications to the Executive Committee as deemed desirable.

Chairperson: Daniel L. Jensen, The Ohio State University
 Jacob G. Birnberg, University of Pittsburgh
 Susan F. Haka, Michigan State University

Terrence B. O'Keefe, University of Oregon
 Robert Rousse, University of Southern California
 Wilfred Uecker, Rice University
 William Waller, University of Arizona

RELATIONS WITH TWO-YEAR COLLEGE FACULTY COMMITTEE

- Charge:* 1. To recommend measures to the Executive Committee of the American Accounting Association that will serve the AAA's Two-Year College members.
 2. To aid in the integration of Two-Year College educational contributions with Four-Year and Graduate Colleges.
 3. To promote the membership of Two-Year College faculty in the American Accounting Association.
 4. To work closely with the Two-Year College Section, with the goal of merging the committee's activities with those of the section.

Co-Chairpersons: Robert Capettini, San Diego State University
 Lynn M. Paluska, Nassau Community College
 Craig Christopherson, Richland College
 Teddy L. Coe, University of North Texas

Billie Cunningham, Collin County Community College
 Karen L. Hooks, University of South Florida
 Joseph Schultz, Arizona State University
 Ellen Sweatt, DeKalb College-North

RESEARCH ADVISORY COMMITTEE

Charge: To advise the Vice President of Research in the development and administration of the Association's program in accounting research.

Chairperson: Katherine Schipper, University of Chicago
 Julie H. Collins, University of North Carolina
 Joel S. Demski, Yale University
 Nicholas Dopuch, Washington University
 Robert Freeman, University of Texas at Austin

Robert Holthausen, University of Pennsylvania
 Bruce Johnson, University of Iowa
 David F. Larcker, University of Pennsylvania
 Barry L. Lewis, University of Colorado at Boulder
 Ira Solomon, University of Illinois

SECURITIES AND EXCHANGE COMMISSION LIAISON

- Charge:* 1. To prepare and transmit a response to the staff of the Securities and Exchange Commission on proposals soliciting views from the public concerning auditing and financial accounting and reporting.
 2. To make recommendations and to develop program(s) that will assist teaching of and conducting research in topics concerning the SEC and its activities.
 3. To conduct activities as appropriate to assist communications and interactions between the SEC and the membership of the Association.

Chairperson: Robert J. Sack, University of Virginia-Grad
 Dan S. Dhaliwal, University of Arizona
 Robert Eskew, Purdue University

Jack Krogstad, Creighton University
 Marcia S. Niles, University of Idaho
 Thomas R. Weirich, Central Michigan University

SEMINAL CONTRIBUTIONS TO ACCOUNTING LITERATURE AWARD

Charge: To select the recipient(s) of the award from those books and articles identified by the membership as having made a seminal contribution to the accounting literature.

Chairperson: William Beaver, Stanford
University
Rick Antle, Yale University

Victor Bernard, University of Michigan
Robert Kaplan, Harvard University
Robert Libby, Cornell University

TAIWAN ACADEMIC ACCOUNTING CONFERENCE PLANNING COMMITTEE

Charge: To plan and implement the November 1993 AAA Executive Taiwan Conference.

Co-chairpersons: Chen-en Ko, Rong-Ruey Duh,
National Taiwan University

TRUEBLOOD SEMINARS COMMITTEE

Charge: 1. To assist Deloitte & Touche in conduct of the Trueblood Seminars.
2. To report on the results and effectiveness of the seminars and to recommend changes by August 1, 1994.

Chairperson: Robert N. West, University of
Virginia
Averil Brent, Columbia University

Robert Hoskin, University of Connecticut
Albert Mitchell, James Madison University
James William, Florida A&M University

WILDMAN MEDAL AWARD COMMITTEE

Charge: To administer the John R. Wildman Medal award program in accordance with the terms of the grant from the Deloitte & Touche Foundation.

Chairperson: Gerald Salamon, Indiana University
Mark Chain, Deloitte & Touche
Roland Dukes, University of Washington

Lisa Koonce, University of Texas
Morley Lemon, University of Waterloo
Ira Solomon, University of Illinois

OCCASIONAL REVIEWERS AND ASSOCIATE EDITORS

The following faculty members have graciously donated their time and expertise to assist in evaluating manuscripts for *The Accounting Review* between June 1992 and November 1993. Their support is greatly appreciated. *The Editor.*

- Jeffrey Abarbanell, University of Michigan
 Anwer Ahmed, University of Florida
 Mimi Alciatore, Southern Methodist University
 Michael Alles, University of Texas at Austin
 Eli Amir, Columbia University
 Barbara A. Apostolou, Louisiana State University
 Stephen Asare, University of Florida
 Stephen P. Baginski, Florida State University
 Andrew D. Bailey, Jr., University of Arizona
 Stanley Baiman, University of Pennsylvania
 Bala Balachandran, Northwestern University
 Rajiv D. Banker, University of Minnesota
 Sasson Bar-Yosef, The Hebrew University of Jerusalem
 Ran BarNiv, Kent State University
 Eliahu Bartov, New York University
 Allen W. Bathke, Jr., Florida State University
 Randolph P. Beatty, Southern Methodist University
 William H. Beaver, Stanford University
 Jean C. Bedard, University of Connecticut
 Messod D. Beneish, Duke University
 Gary C. Biddle, University of Washington
 Michael E. Bradbury, University of Auckland
 Richard P. Brief, New York University
 Clifton E. Brown, University of Illinois at Urbana-Champaign
 Lawrence D. Brown, SUNY-Buffalo
 Frank P. Buckless, North Carolina State University
 Jeffrey L. Callen, New York University
 Ramesh Chandra, University of Windsor
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 Joseph K. Cheung, George Mason University
 Freddie Choo, San Francisco State University
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 Somnath Das, University of California-Berkeley
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 Larry R. Davis, University of Minnesota
 Michael L. Davis, Lehigh University
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 Rajiv Dewan, Northwestern University
 Dan S. Dhaliwal, University of Arizona
 William N. Dilla, University of Missouri-St. Louis
 Alex Dontoh, New York University
 Gordon Leon Duke, University of Minnesota
 Alan S. Dunk, University of Western Sydney
 Richard B. Dusenbury, Florida State University
 Ronald A. Dye, Northwestern University
 Samir M. El-Gazzar, Pace University and University of Tanta, Egypt
 Rachamin Elitzur, University of Toronto
 Kirsten M. Ely, University of California-Los Angeles
 Craig Emby, Simon Fraser University
 Charles R. Enis, Pennsylvania State University
 Brian Erard, University of Toronto
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 William L. Felix, Jr., University of Arizona
 Ehsan H. Feroz, University of Minnesota-Duluth
 Lourdes D. Ferreira, University of Baltimore
 Catherine Finger, Illinois State University
 David R. Finley, Simon Fraser University
 Joseph Fisher, Wake Forest University
 James C. Flagg, Texas A&M University
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 Jennifer Francis, University of Chicago
 Robert N. Freeman, University of Texas-Austin
 Veronique Frucot, Rutgers University-Camden
 Jennifer J. Gaver, University of Georgia
 Dipankar Ghosh, University of Oklahoma
 Michael Gift, Southern Methodist University
 Gary Giroux, Texas A&M University
 Froystein Gjesdal, Helsinki School of Economics and Business
 James T. Godfrey, George Mason University
 Martin F. Grace, Southern Methodist University
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 Carla K. Hayn, Northwestern University
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 Mark Hirst, University of New South Wales
 Peggy A. Hite, Indiana University
 Lin-Chin Ho, University of Texas-Austin
 Robert W. Holthausen, University of Pennsylvania
 Keith Houghton, University of Melbourne
 Carol Olson Houston, San Diego State University

- Steven Huddart, Stanford University
 Yuhchang Hwang, University of Pittsburgh
 Rhoda C. Icerman, Florida State University
 Yuji Ijiri, Carnegie Mellon University
 Eugene A. Imhoff, Jr., University of Michigan
 Raffi Indjejikian, University of Chicago
 Karim Jamal, University of Alberta
 Cynthia Jeffrey, Iowa State University
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 Scott K. Jones, University of Delaware
 Sok-Hyon Kang, Carnegie Mellon University
 Robert S. Kaplan, Harvard University
 Duane B. Kennedy, University of Waterloo
 Inder Khurana, University of Missouri-Columbia
 Ronald King, Washington University
 William R. Kinney, Jr., University of Texas-Austin
 Michael C. Knapp, University of Oklahoma
 S. P. Kothari, University of Rochester
 Leslie Kren, University of Wisconsin-Milwaukee
 William J. Kross, Purdue University
 William N. Lanen, University of Michigan
 Mark H. Lang, Stanford University
 Amy H. Lau, Oklahoma State University
 Raef A. Lawson, SUNY-Albany
 C. F. Lee, University of Michigan
 John C. Lere, St. Cloud State University
 Baruch Lev, University of California-Berkeley
 Stephen T. Limberg, University of Texas-Austin
 Gerald J. Lobo, Syracuse University
 Kenneth S. Lorek, Florida State University
 Russell Lundholm, University of Michigan
 Joseph Magliolo III, Southern Methodist University
 Lauren Maines, Duke University
 Ella Mae Matsumura, University of Wisconsin-Madison
 William E. McCarthy, Michigan State University
 Kathleen T. McGahran, Columbia University
 Morris McInnes, Suffolk University
 Janet Meade, University of Houston
 Nahum Melumad, Stanford University
 Krishnagopal Menon, Boston University
 Yaw M. Mensah, Rutgers University-New Brunswick
 Shehzad Mian, Emory University
 H. Fred Mittelstaedt, University of Notre Dame
 Cindy Moeckel, Arizona State University
 Mary Beth Mohrman, University of Missouri-St. Louis
 Maryanne M. Mowen, Oklahoma State University
 Susan E. Moyer, University of Washington
 Arijit Mukherji, University of Minnesota
 Siva Nathan, Michigan State University
 John Neill, Florida State University
 Mark W. Nelson, Cornell University
 John Neter, University of Georgia
 Marcia S. Niles, University of Idaho
 Chris Nobes, University of Reading
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BOOK REVIEWS

Shane Moriarity, Editor

Editor's Note: Two copies of books for review should be sent to Dr. James Boatsman, Office of the Chief Accountant, U.S. Securities and Exchange Commission, Washington, DC 20549. The policy of the *Review* is to publish only those reviews solicited by the Book Review Editor. Unsolicited reviews will not be accepted.

R. C. BILLING et al., *Environmental Auditing and the Role of the Accounting Profession* (Toronto: The Canadian Institute of Chartered Accountants, 1992, pp. xiv, 156, C\$34.50, paper).

The "greening of business" has become a dynamic and rapidly evolving area in both audit and non-audit circles. Demand for environmental accountability and disclosure from a wide range of interested parties has been the genesis of much of the current interest. This Research Report, prepared by a study group for the Canadian Institute of Chartered Accountants (CICA), provides an in-depth discussion of the services currently being touted as "environmental audits." Although some differences exist between the United States and Canada concerning current professional attestation standards and governmental regulations, the report presents a thorough discussion of the multi-disciplinary nature of environmental management and environmental audits that will be useful to a wide array of constituencies from both countries.

The two primary objectives of the report were to: (1) investigate what environmental auditing is and is not, and (2) determine the role public accounting can play today and in the future. The report is intended to stimulate discussion and is not an authoritative CICA pronouncement. Accordingly, no audit programs or procedures are prescribed. However, the Appendices include several useful environmental risk assessment checklists prepared and used by environmental law groups and commercial lending institutions, and a diagram of the basic steps in an environmental audit.

In addressing its objectives, the report first defines what constitutes an audit (based on the AAA Statement of Basic Auditing Concepts, 1973), and then utilizes this definitional foundation to evaluate various environmental service activities and the requisite skills needed to perform these services. The report identifies four general types of environmental services: (1) environmental consulting services, (2) site assessments, (3) operational compliance assessments, and (4) environmental management system assessments. Of the four, presently only the last two could potentially be considered audits under certain verifiable assertion conditions as defined in the report, with environmental management system assessments currently being the primary area for auditor involvement in providing assurance. The report, however, fully discusses all four types of services in terms of the users of this service and resultant information, the skills necessary to perform the services, the assurances to be provided, and whether there are presently any service standards to evaluate performance. The report also compares environmental services with other types of auditing services and discusses the general legal and regulatory context in Canada, the United States, and Europe.

The concluding chapter of the report contains an excellent summary of the report's six chapters of insightful detailed discussion and presents twelve recommendations to guide public accounting in facilitating the development of environmental audit areas, as well as sets forth recommendations for the CA profession to establish standards and guidelines to assist accounting professionals in providing competent and credible services to their present and potential environmental audit clients.

The study group that prepared this report should be commended on an excellent job of fulfilling their main objectives and by reducing the current confusion of terminology and concepts surrounding environmental activities. The report provides a comprehensive, detailed discussion of a complex and emerging area of concern to external and internal auditors, Boards of Directors, lawyers, stockholders, regulatory officials, environmental engineers and scientists, and others involved with these present and potential services.

In summary this report is a valuable resource for anyone interested in a discussion of the current state of environmental audits and other related environmental services, as well as those interested in an indication of some potential directions and influences public accountants can make in this emerging field.

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JOHN M. BOERSEMA and SUSAN J. VAN WEELDEN, *Financial Reporting for Segments* (Toronto: The Canadian Institute of Chartered Accountants, 1992, pp. xiv, 237, C\$39.50, paper).

This research report looks at whether the Canadian financial reporting requirements for disclosure of segmented information, last updated in 1979, need to be revised. Boersema and Van Weelden approached this task by examining annual reports of diversified Canadian companies and conducting interviews. Those interviewed were primarily financial analysts, representatives of diversified Canadian companies, and auditors. Responses of officials of Canadian regional securities commissions and government statistical collection/reporting agencies are also reported. Many excerpts from the interviews are interspersed throughout the study, giving the reader insight into the thoughts and rationale used by the various parties to support their positions on appropriate disclosure levels.

The study is rooted in financial reporting's role in providing information to assist users in assessing future prospects. Boersema and Van Weelden chose financial analysts as representative of investors and their information needs. Based on the results of interviews with 33 financial analysts, the research study was written with an emphasis on issues relating to expanding:

- industry segment definition (chapters 3 and 4),
- geographic segment definition (chapter 5),
- the scope of segment reporting (chapter 6), and
- the content of segment reporting (chapter 7).

Each chapter includes overviews of relevant reporting standards from several English speaking countries and also international standards of the International Accounting Standards Committee, the United Nations, and the Organization for Economic Cooperation and Development. Summaries of prior surveys on related issues, mostly involving U.S. audiences, are also included in the discussion. Generous servings of comments gleaned from the interviews of financial analysts, corporate officials, auditors, and others add individual perspectives to each topic. Each chapter ends with specific recommendations for changing Canadian reporting standards.

Appendix 1 contains summaries of segment reporting requirements in Canada, the United States, the United Kingdom, New Zealand, and Australia. There is also information about international pronouncements and brief overviews of segment reporting regulations in Japan and European Community nations. Appendix 5 contains abstracts of 11 empirical research studies on segment reporting published in the 1980s.

Readers are not likely to perceive this study as an impartial examination of the merits of an expansion of segment disclosure by Canadian companies. It would be better described as a collection of arguments and citations from prior literature favoring disclosure of the additional information desired by the analysts interviewed. The study takes the position that "... the detailed notes to the financial statements (including those on segment information) should be designed to meet the needs of analysts and other sophisticated shareholders; the average shareholder probably does not peruse such notes in great detail" (p. 90). Need for information was determined solely from the interview responses of analysts. No experiments were performed to determine whether analyst decisions would actually be affected by making the information available. Efforts to determine whether other financial statement user groups have needs similar to those of the analysts interviewed were limited. Positions unfavorable to additional disclosure, such as potential costs of additional disclosure and potential competitive disadvantage to firms providing more detailed segment information, were also presented in the study. However, these positions seem underdeveloped in comparison to arguments in favor of additional disclosure.

Financial Reporting for Segments provides a useful summary of global reporting regulations and a summary of both survey literature (in text) and empirical research (Appendix 5) on segment reporting. This book would be useful in any upper level course addressing financial disclosure and the information needs of financial report users. The book's liberal use of direct quotes from analysts, company officials, and auditors along with the conclusions drawn by the authors could be used as fuel to spark extensive discussion and debate about the benefits and disadvantages of detailed financial disclosure.

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STEPHEN A. BUTLER, Editor, *Earnings Quality* (The Center for Economic and Management Research, University of Oklahoma, 1993, pp. 183, \$15.00).

This volume contains six papers and related discussant comments from a conference sponsored by the Oklahoma Center for Research in Accounting held at the University of Oklahoma on November 19 and 20, 1992. As evident in the title, the topic of the conference was Earnings Quality.

The papers contained in the volume provide an interesting mix of approaches that researchers have taken to address the somewhat broad issue of earnings quality. The volume is an excellent introduction to this general area of research for Ph.D. students as it illustrates how an issue can be researched from many different perspectives and methods. The papers themselves are, on the whole, innovative in the approaches that have been taken and can provide much food for thought for Ph.D. students and other researchers. The discussant comments are also excellent and not only point out weaknesses in the papers but offer suggestions for improving the research and ideas for additional approaches that might be taken. At the end of the volume Vic Bernard summarizes the papers presented at the conference and concludes on an upbeat note for the future of this type of research. It is difficult to summarize the papers in any collective way so I choose, instead, to present a brief summary of each paper:

Potter and Rayburn—"The Impact of Earnings Quality on Discretionary Disclosure: The Case of Interim Reporting." This paper investigates the link between information quality and a firm's disclosure policy using historical data on interim disclosure policies of firms prior to the SEC mandate for quarterly reporting. Logit analysis was used to test the primary hypotheses. One conclusion drawn from the results is that firms with high quality earnings were more likely to be reporting on a quarterly basis than firms with low quality earnings.

Neill—"Accounting Quality and the Long-Term Mispricing of Initial Public Security Offerings." This paper investigates the relationship between IPO mispricing and accounting information quality by examining risk-adjusted aftermarket returns. Accounting quality is measured using three surrogates, one of which is the reputation of the auditor utilized in the IPO process. Two results were that the risk-adjusted aftermarket returns were significantly negative over the initial three year time horizon which is contrary to market efficiency, and the variance of the returns increased as the level of uncertainty surrounding accounting quality increased.

Stober—"Positive and Negative Inventory Divergence: Testing Thornton O'Glove's Analysis of the Components of Manufacturing Inventories." This paper tests the predictive ability of a concept known as positive and negative inventory divergence that is discussed in a book by Thornton O'Glove. The results of the study do not support O'Glove's hypothesis.

Morton and Shane—"Firm Size and the Predictive Ability of Financial Statement Analysis." This paper extends the financial statement analysis procedure that was introduced by Ou and Penman in 1989 to assess whether firm-size is related to the ability of financial statement analysis to provide information about future earnings. Logit models are used to test the hypotheses and the authors find no evidence that small firms are any different from large firms in the ability of financial statement analysis to provide information about future earnings that is not already captured by the current price.

Klein and Todd—"The Market Valuation of Earnings and Cash Flows." This paper investigates the relationship between stock returns, unexpected earnings, and cash flows from operations. The authors develop a new variable called a cash conversion coefficient that measures the extent to which earnings reported in one period are ultimately converted into cash. This cash conversion coefficient is found to have a positive and significant relationship with the earnings response coefficient and that this coefficient does not proxy for other variables that have been found to be associated with returns.

Lipe and Kormendi—"The Implications of the Higher-Order Properties of Annual Earnings for Security Valuation." This paper investigates the higher-order times-series properties of earnings and their implications for security valuation. While difficult to succinctly summarize, the authors conclude the paper with the following: "Taken as a whole, the evidence indicates that the higher-order properties of annual earnings exhibit economically and statistically significant mean reversion and the cross-firm differences in these properties are associated with differences in the return responses to earnings shocks, as predicted by classical valuation" (162).

I believe that this book could be used effectively as one component of a Ph.D. seminar on markets research.

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CAROLE B. CHEATHAM and LEO R. CHEATHAM, *Updating Standard Cost Systems* (Westport, CT: Quorum Books, 1993, pp. xiv, 233, \$59.95).

The ever-changing manufacturing environment clearly presents difficult challenges for managers and practicing accountants. Fortunately, these same dynamics have served well as catalysts in recent years for constructive thinking throughout the field of management accounting. *Updating Standard Cost Systems* is a well-conceived effort to confront the varied challenges posed by complex manufacturing activities. This book presents a pragmatic, cost-effective "bridge" between time-tested standard costing systems and emerging practices now used extensively in progressive enterprises.

Cheatham and Cheatham offer many thoughtful suggestions about "updating" traditional standard costing systems to emphasize continuous improvement goals. Some of the authors' observations are undoubtedly original and thus, perhaps, untested in real-world settings. Many others, however, are based on views expressed by experienced executives. This integration of original thinking and practical perspectives results in a useful frame of reference for working toward improvements in existing cost management systems.

Updating Standard Cost Systems contains 13 well-written chapters. Chapters 1 and 2 present descriptions of emerging cost management practices which are now prevalent in successful manufacturing companies. Discussions consider both the strengths and weaknesses of these practices in terms of achieving continuous improvement targets. Chapters 3 through 9 are directed to system "updating" issues. Particularly effective are practical ideas about ways in which "traditional" standard cost systems can be updated—with reasonable cost-effectiveness—to improve the quality of information provided for planning and control decisions. The remaining content, Chapters 10 through 13, considers numerous opportunities for "updating" other management accounting practices. Considered in this regard are information systems, marketing activities, and possible extensions of measurement techniques now used in evaluating capital investment proposals.

Of this book's many strengths, three features are especially noteworthy. First is the effectiveness of its central message: practicing managers and accountants should consider carefully the potential usefulness of "updated" standard cost systems as a foundation for monitoring cost management progress. Updated systems are viewed as "informational linkage" between a company's previous costing results and future-oriented target costs. The resulting comparative measures can also serve as bases for the versatile costing databases addressed in both Chapter 7 (pp. 95-96) and Chapter 9 (pp. 124-125). A second important strength stems from the authors' conscientious efforts throughout the book to provide meaningful illustrations of their "updating" ideas. And third, this book excels in presenting discussions which integrate views from a broad range of historical and contemporary references.

Nevertheless, this effort is not without perceived weaknesses. Of concern are observations in the final two chapters. Here, the authors attempt to extend the "updating of standard cost systems" well beyond the domain of time-tested practices. What I found troublesome is their unnecessary grounding of the capital budgeting discussions in a purely theoretical context. At issue are references that relate only to publicly-held organizations—maximizing the intrinsic value of a firm's stock (p. 168) and beta coefficients (p. 185). To me, these discussions do not complement the book's "system updating" theme. Also, they do not seem to contribute substantively to those who seek practical, useful knowledge about improving cost management practices.

On balance, however, my view is that this work makes a positive contribution to the management accounting literature. Its strengths are far more compelling than any minor weaknesses. "Updated" standard cost systems are positioned at the center of the crossroads between tradition-laden costing practices and future-oriented databases. The authors' suggestions in each chapter are effectively presented, and their views are supported by examples and well-reasoned observations where appropriate. These interesting discussions have demonstrated to my satisfaction that the alternative of "updating" systems is indeed viable! Given this book's many positive attributes, readers from varied audiences—practicing managers and accountants, academics, and students—can benefit from a study of its contents.

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MARC J. EPSTEIN and ALBERT D. SPALDING, JR., *The Accountant's Guide to Legal Liability and Ethics* (Homewood, IL: Richard D. Irwin, Inc., 1993, pp. xviii, 296, \$17.50, paper).

At a time when legal liability may seem to some to be overtaking and overwhelming the public accounting profession, a high quality treatment of the subject, as well as many of the ethical and professional behavior concepts that relate to it, is welcomed. This effort is at the same time thorough and well written. The legal and ethical concepts are technical, but the authors have carefully provided non-technical summaries and explanations of the concepts developed and the substantial number of cases provided in support of the legal points. The chapters provide extensive notes (averaging almost 50 per chapter) supporting factual statements made by the authors and providing substantial assistance to those wanting to research issues further.

Although the book is not divided into sections, the chapters (other than the introduction and conclusion) lend themselves to three basic groupings. First, Chapters 2-7 make up the legal liability "heart" of the book. They provide historical development of the various forms of professional responsibility (common law liability to clients and third parties, civil and criminal statutory liability, discovery of fraud and control weaknesses, and reporting responsibilities). This development is supplemented frequently and well by references to, and discussion of, precedent setting cases. These chapters include several figures flowcharting liability logic rules.

Second, Chapters 8-10 address responsibilities associated with services other than auditing provided by CPAs (i.e., tax engagements, litigation support, internal control reviews, fraud audits, fiduciary accounting engagements, and other consulting services). The liability ramifications of these chapters seem less clear than in Chapters 2-7. The discussion focuses on the CPA's "professional responsibility" when providing these services, rather than legal liability derived from providing such services. Chapter 11 pertaining to professional insurance is short and somewhat elementary. The chapter discusses the types of liability insurance, how to obtain it, and how to report a claim. It doesn't seem to fit well within the other chapters.

Third, Chapters 12-13 pertain to professional ethics. The coverage here is rather limited and somewhat misdirected. The inclusion of ethics and legal liability in the same book implies that legal liability can be affected by increased attention to ethics and improved ethical behavior. The authors provide this connection when they posit that relative to legal liability, "If promulgated GAAP and GAAS are incomplete, and if judicially ascertained professional standards are dynamic and unpredictable, what behavioral precepts are, in fact, reliable? The answer is both obvious and enigmatic: in a word, ethics" (p. 228).

In a treatment of ethics and legal liability in the same work, it would seem that ethical behavior should be the independent variable and legal liability a dependent variable resulting from a CPA's application, or lack thereof, of an appropriate standard of ethical excellence. This would argue for the treatment of ethics first in the book and legal liability second. It would argue, also, for a more extensive treatment of ethics. Only two chapters are included in this work and most of the coverage (24 of 41 pages) is devoted to the AICPA's Rules of Professional Conduct, and Rulings. Because these rules can be viewed as the "minimum standard," improvement in professional behavior, and liability avoidance, might be improved by more elaborate discussion of the necessity to the profession of adherence to the philosophical principles of ethics, rather than focus on simply the rules.

The most likely audiences for this book would be (1) educators and students, (2) public accounting practitioners and, (3) attorneys.

Educators and students. In the classroom, this book would best be suited for a capstone, course in professional programs where large numbers of the students are committed to careers in public accounting. In the typical undergraduate auditing course where only a class period or two can be devoted to legal liability, the coverage in the book may be too extensive for complete inclusion.

Public accounting practitioners. The work is a useful guide to inform this group of the threats and pressures that exist in the legal environment of public accounting practice. It provides substantial guidance to accountants "on how to conduct their practices in ways that minimize their potential legal liabilities" (p. viii). It is not likely to be the definitive solution to complex practice problems, but it would provide valuable assistance in the research effort, particularly for smaller CPA firms without the resource of litigation support personnel. To assist further in research, the book includes a thorough set of references and a substantial index.

Attorneys. For this group, the work is a well written introduction and reference guide to the legal environment of public accounting. It would serve as an excellent genesis for their research efforts on a case involving an accounting firm.

The authors recognize that the legal environment in accounting is a constantly evolving one. Supplementary interim updates are offered at extra cost (as the authors develop them) covering ongoing issues pertaining to significant court decisions, legislative developments, GAAS and GAAP pronouncements, and other professional developments related to the subject area.

In summary, the book provides a well-written, and easy-to-read overview of a reasonably complex subject area. It can be used successfully in teaching the subject matter to accounting students or as a fairly thorough resource guide to accounting and legal practitioners.

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MICHAEL HALPERIN and STEVEN J. BELL, *Research Guide to Corporate Acquisitions, Mergers, and Other Restructuring* (New York: Greenwood Press, 1992, pp. xv, 208, \$49.95).

This book is designed to help researchers cope with the special characteristics of merger and acquisition (M&A) research. It consists of nine chapters, two appendices, a glossary, a bibliography, and an index. The emphasis is on developing an awareness of the wide variety of computer-readable databases that are currently available through commercial online systems. Descriptions of these databases are sufficiently detailed to provide initial guidance in planning the data acquisition phase of an M&A research project. More specific information about each database can be obtained by using the source information provided.

The nine chapters of text progress through the M&A research planning process—concluding with an information checklist. Chapter 1 describes the many types of corporate changes that can alter the structure and identity of a corporation. A comprehensive discussion of these changes is provided, with classic definitions adopted from several dictionaries. However, since the arrangement of these concepts is alphabetical, a unifying framework (e.g., corporate changes affecting assets versus changes affecting equities) would be helpful. Consequently, this chapter requires some prior understanding of the M&A literature and its terminology.

Chapter 2 describes ways to monitor corporate change with print resources. Newspapers, business magazines, trade journals, and newsletters are discussed.

Chapter 3 focuses on electronic resources. It describes the time-sharing environment and reasons for conducting electronic searches. The emphasis, however, is on describing, in reasonable detail, the primary time-sharing databanks that are currently available, such as DIALOG and Dow Jones News Retrieval. Examples of menu-driven and command-driven searches are provided for several databanks. The discussion is insightful and the level of detail is appropriate.

Chapter 4 discusses the Williams Act and the Securities and Exchange Commission filings that it requires. Filings related to proxy fights, leveraged buyouts, tender offers, and other events are covered. M&A research requiring access to these documents is discussed and electronic sources are identified.

Chapter 5 covers M&A transaction databases. While a search for information in a filings database would retrieve one or more filings, a similar search in a transaction database would retrieve a single record focusing on a single transaction. Also, unlike a filings database, a transactions database provides information about the outcome of an M&A transaction. An interesting point that is made is the likelihood of retrieval differences among databases. Different results are frequently produced when screening different databases for the same characteristics. Several reasons for obtaining such differences are given, including definitional differences. The focus of this chapter is on describing these transactional databases and on providing key examples of database screens.

Chapter 6 describes the process of screening acquisition candidates. Examples of screening characteristics include financial variables, industry membership, market share, patents, and trademarks.

Chapter 7 focuses on the muddled corporate identity. Since the question “who owns whom” is fundamental to understanding corporate relationships, this chapter first describes how to answer this question using corporate affiliation files. In addition, ways to obtain corporate histories and to screen for corporate events are discussed.

Chapter 8 concentrates on international M&A activity. Accordingly, techniques are stressed which can help identify M&A activity between different countries, whether or not the United States is one of the

countries involved. Since few publications are dedicated to international transactions, this is an extremely useful chapter.

Chapter 9 provides an information checklist that helps summarize the preceding chapters. Categories include company background information, financial information, industry information, marketing information, legal information, and strategic information. In addition, complex conceptual questions are discussed. Answers to these questions generally involve interpretation, judgment, and opinion beyond the gathering of factual information. In the final section, trends in M&A research are discussed. The authors suggest that retrieval speed and display capabilities will improve together with an ability to integrate text and image material. Consequently, M&A research will improve as well.

In summary, this is an extremely useful book for researchers interested in M&A activity. It provides a comprehensive guide to the M&A research planning process. It also points out areas where information gathering difficulties are likely to be encountered.

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AHMED RIAHI-BELKAOUI and ELLEN L. PAVLIK, *Accounting for Corporate Reputation* (Westport, CT: Quorum Books, 1992, pp. xiv, 253, \$49.95).

In recent years the topic of accounting for corporate reputation has increasingly appeared in the literature of the accounting profession. Firms now engage in the dissemination of various accounting signals in order to create favorable reputations. However, as noted by the authors, since conventional signals are not generally sufficient, companies need to reinforce accounting signals with nonaccounting signals.

These nonaccounting reputation measures focus on the concepts of corporate social performance and organizational effectiveness. The book states that a good understanding of these signals is needed in order to efficiently and effectively manage firm resources.

The first two chapters of the book deal with the nature and measurement of social performance and organizational effectiveness respectively as presented in the accounting, management, and sociological literature. In the first chapter the authors explore the nature and importance of reputation signals assigned to U.S. firms. Accounting-based models that can be used to explain and predict these signals are reviewed. Since the measurement of social performance falls within the area of social accounting, this chapter should be a valuable source of ideas for students, including researchers interested in social responsibility accounting and accountants interested in the management and accounting for reputation.

Chapter 2 deals with the nature and measurement of organizational effectiveness. The authors attempt to define organizational effectiveness through a review of the literature, but find variability in definitions of the concept. The literature on organizational effectiveness indicates various approaches to the concept of organizational effectiveness. Although each approach has some advantages, they each lead to problems of definition and measurement. Chapter 2, like Chapter 1, does not provide us definitive answers to problems. However, as in Chapter 1, the student of social accounting will find a great many well-advanced ideas on social accounting that have been published.

Because firms tend to differ in terms of their social performance and organizational effectiveness, Chapter 3 attempts to identify the determinants of these differences. In this chapter, various accounting and nonaccounting variables used to build explanatory and/or predictive models of reputation are examined. For example, the decision to disclose social information was found to be positively correlated with social performance, economic performance, and political visibility. Also, it was noted that accounting variables can be good predictors of reputation building.

Chapter 4, *Corporate Reputation and Shareholder's Wealth*, explores the potential relationship between disclosures of social information and shareholders' wealth. The authors conclude that it is indeterminate whether social disclosure effects a positive or negative market reaction.

In Chapter 5, utilizing five years of data amassed by *Fortune* magazine, the authors present the market's reaction to the disclosure of reputation signals and the five year (1986-1991) performance of U.S. firms on each of eight key attributes of reputation. The chapter explores the phenomena of reputational rankings in a narrative fashion. This chapter, along with its appendix, covers 140 pages, which is approximately one-half the book. I believe this chapter could be strengthened by the inclusion of more analysis and conclusions based on the abundance of descriptive material in the chapter.

Overall, despite the above criticism, I believe this book achieves its basic goal, which is to examine the issues relating to accounting for corporate reputation. The book contains a useful collection of the constructs underlying reputation and models of the determination of corporate reputation. It should have a wide appeal to anyone with an interest in social responsibility accounting.

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CRISPIN SIMON, *The Role of the Accountant in Strategic Planning: A Model for the 1990s* (Brookfield, VT: Gower Publishing Company Limited, 1992, pp. x, 116, \$49.99).

The Role of the Accountant in Strategic Planning is the second of a series of books sponsored by the Institute of Chartered Accountants' Board of Chartered Accountants in Business of Great Britain (BCAB). The stated purpose of the series is to explore some of the challenges faced by private accountants and "look at ways in which the accountant could enhance ... role in the management of a business" (p. 3). Increasingly, accountants have a much broader obligation to their organizations than the collection and presentation of financial data. Given rapid technological changes and unstable business environments, extending the traditional accountant's role to strategic planning is a particularly timely and relevant goal.

The book has three interrelated parts. The first presents the results of a survey of BCAB members. These survey results document the duties and roles of accountants within organizations. The results illustrate that accountants have the training and skills, as well as the access to information, needed to be successful participants in strategic planning. The survey also reveals, however, how accountants' own perceptions of their roles (as well as their colleagues' perceptions) hamper their participation in strategic planning.

A case study is presented in the second section that sets the context for an accountant's involvement in corporate strategy. In this case, a controller's company faces a hostile takeover. Although first dismissed as having only an ancillary role, the accountant eventually plays a significant role by analyzing the competitive advantages of the firm. The two familiar but key issues of business strategy are identified in the case. That is, whether the firm is competing in an attractive market, and, whether the firm can be successful in that market. In addition to the illustration of corporate strategy analysis, the case reinforces the book's assertion that accountants have the training, experience, and access to information required for strategic planning.

The third section describes various analytic tools and their use in strategic planning. If the book has weaknesses, they are revealed in this section. The sophisticated reader will find these tools somewhat basic, ranging from simple financial statement analysis to the relation between accruals and cash flows. Also, the use of British firms to illustrate the tools can be confusing to the American reader without prior knowledge of British industry. Even so, the corporate examples illustrate the application of the analytic tools reasonably well.

Much recent literature addresses the changing role of private accountants. Computerization has taken over many traditional accounting functions and the so-called "management style of the 90s" stresses more integration and cooperation between management functions. Successful accountants will be increasingly involved in less traditional information analyses. This book provides an enlightening introduction to the accountant's potential role in business and strategic planning. For this reason, the material presented in this book should prove useful to both practitioners and teachers of accounting.

ROGER C. GRAHAM, JR.
Assistant Professor

Oregon State University

J. DAVID SPICELAND and SURENDRA P. AGRAWAL, editors, *International Guide to Accounting Journals, Second Edition* (Princeton & New York: Markus Wiener Publishing, Inc., 1993, pp. vi, 314, \$49.95).

This book provides information relating to worldwide academic and professional journals that publish articles on accounting topics. The authors provide information about 304 journals from 35 countries, presented alphabetically by journal title with a separate listing by country in which the journal is published. While this guide is international, the articles published by the journals are not limited to international

accounting topics. In fact, the information provided is intended to assist all accounting researchers in identifying appropriate publication outlets for their research.

Among the data provided are review information, manuscript and publication guidelines, circulation data, and addresses for submission of manuscripts. In addition, this edition of the book furnishes four new categories of data in order to further assist authors in determining the suitable journal(s) for their manuscript. The data consist of: (1) the approximate percentage of articles on accounting topics published in each journal; (2) the approximate percentage of accounting related articles devoted to each area of accounting (i.e., financial, managerial; computers/systems, tax, auditing, international, governmental, education, and others); (3) the approximate percentage of accounting related articles characterized by methodology (i.e., empirical, experimental, analytical, interpretational, and other); and (4) the language(s) in which articles are published and whether the journal accepts manuscripts in English for translation when the language of publication differs from English.

While the additional categories are intended to aid researchers, a large portion of the journal listings unfortunately do not contain the information. For instance, in the first category, over 28 percent of the journal descriptions do not contain information on the acceptance rate of articles on accounting topics. In the second and third categories, the percentages are over 40 and 50 percent, respectively.

The second edition updates the information for each journal that was presented in the first edition (see the April, 1990 issue for the review of the first edition). However, the data for over 20 additional journals have been added in the second edition including one from Belgium and another from Croatia, countries not represented in the first edition.

Overall, the book achieves its objectives to serve researchers in identifying suitable journals for publishing their research, and to provide readers an excellent source of information about the journals. The book is a welcome addition for academicians and practitioners needing a guide to accounting publications.

FARA ELIKAI

Associate Professor of Accounting

University of North Carolina at Wilmington

ROGER Y. W. TANG, *Transfer Pricing in the 1990s: Tax and Management Perspectives* (Westport, CT: Quorum Books, 1993, pp. xviii, 143, \$45.00).

Although the unifying theme of this book is transfer pricing, the book presents a number of seemingly unrelated aspects of the issue. Early on, the author briefly discusses the transfer pricing rules required for tax purposes in the United States, Canada, Japan, South Korea, and the European Community. The book then reviews the descriptive empirical literature concerning transfer pricing practices of large U.S. companies. All of this leads up to the description of the results of the author's own questionnaire survey of the transfer pricing practices of 143 *Fortune* 500 firms, about 80% of which have at least one foreign subsidiary. The questionnaire asks companies to explain the transfer pricing methods they use for foreign and domestic transfers and to state the importance of 20 "environmental variables" on their transfer pricing decision. The results are then compared with the results of a similar study done by the author in 1977.

With the exception of five appendices which take up 29 pages, the book itself contains 108 pages divided into seven chapters. The book's brevity is both a strength and a weakness. The strength is that the book makes for rather quick reading. The weakness is that the book does not devote enough space to teach readers who are ignorant of the subject matter. For example, the discussion of transfer pricing methods for tax purposes does little more than list the available methods. Readers who need a more detailed explanation are forced to consult another source. In addition, the discussion of U.S. taxation transfer pricing rules is out of date. Since the publication of the book, the U.S. has issued temporary Regulations (TD 8470) dealing with transfer pricing.

The pattern of brevity continues into the literature review section. Here, the author uses terms such as "instrumental pricing" without defining them. In the chapters dealing with the questionnaire and the results, the results of the book's study are compared with the author's 1977 study. Environmental variables such as overall profit maximization, tax considerations, and maintaining good relationships with host governments were viewed as most important in both studies. However, on the whole, tax considerations were considered more important to 1990 respondents than to 1977 respondents. This shift in emphasis is not explained, nor does the author present any conjectures. The reader is left to try to draw his or her own implications from the results.

Given the book's terseness, perhaps the most suitable audience for it are those people with a good amount of knowledge of transfer pricing in general and for tax purposes in particular. For this audience, the results of the questionnaire survey shed some light on considerations involved in transfer pricing decisions. For this reader, it was comforting to note that overall profit maximization is the most important criterion in selecting a transfer pricing method. This means that all of us who do research involving transfer pricing who assume a goal of overall profit maximization are making a reasonable assumption. I only wish that the author had drawn more implications from the results of the survey.

For those readers who would like a book which teaches and analyzes, however, this book does not deliver.

ROBERT HALPERIN
Professor of Accounting

Fordham University

GARY TIDWELL, *Anatomy of a Fraud: Inside the Finances of the PTL Ministries* (New York: John Wiley & Sons, Inc., 1993, pp. vii, 357, \$24.95).

Although this book starts as a somewhat repetitive account of the mechanisms Jim Bakker used to lure television audiences into sending money for lifetime partnerships, it turns into an interesting exploration of accounting issues. As expected, the author questions the role of the auditors in this wire and mail fraud. However, detailed descriptions of individuals and of ongoing operations raise questions about taxation, systems, financial, not-for-profit, and managerial accounting. Business ethics, professional responsibility and legal liability are also a focus. As such, this book could be used for an integrated case analysis in a senior capstone or graduate course focusing on business practices and the responsibilities of both the internal and external accountants.

The author, an attorney who spent two years as a securities fraud investigator for the SEC Division of Enforcement, became interested in the PTL Ministry shortly after his arrival on the business faculty at the College of Charleston. His background and proximity to the courthouses where the civil and criminal litigation were held provide the basis for his comprehensive examination. He interviewed many of the individuals involved in the case and personally attended most of the civil and criminal trials.

This book describes gross mismanagement within the organization and recounts the events leading up to a massive wire and mail fraud. Many of the details of this mismanagement are explored in the three chapters where the author raises the questions: Where were the corporate officers, where was the board of directors, and where were the auditors? The author quotes from trial testimony, court exhibits, and sworn depositions. Chapter and appendix exhibits are photocopies of original court exhibits. Included among these are various internal corporate communications and confidential memos prepared by auditors and attorneys.

Of particular interest is the author's assessment and insight into the legal tactics used by the attorneys. For example, he is critical of the approach and the lack of persuasiveness by the attorneys litigating the civil case against Deloitte. However, he speculates on the rationale for the strategy that charged the auditors with aiding and abetting in the fraud rather than with negligence. Deloitte was found not guilty of conspiring with or assisting Jim Bakker in defrauding the lifetime partners, but the author notes that "no determination was made concerning whether Deloitte committed any negligence or professional malpractice" (p. 199). None of the allegations against Laventhol were litigated or resolved because their bankruptcy caused the civil proceedings to be "stayed." Although the author concedes that certain professional activities may have been done in accordance with requirements of the accounting literature, he raises the question of whether truly skeptical professionals would have gone further in their examinations.

The author's stated primary objective was to provide facts to allow readers to make their own judgment as to the propriety of events. Although this conflicts with the stated purpose of critically examining the PTL business practices and the actions of the involved professionals, the author does maintain some level of objectivity. However, 20/20 hindsight periodically allows facts from various sources and time periods to be consolidated to describe events and reach conclusions. It is difficult to detail facts that cover more than a decade, and it is even more difficult to tie together the activities of various parties. Sometimes a discussion would be cut short and the reader told that it would be covered in more detail in a later chapter. At other times there would be a need for the reader to go back and find the identity of a person who had been introduced earlier or to find the timing of an event that was related to the current topic. At those times, it would have been useful to have had a spreadsheet to keep track of the people, dates, and events.

Overall, this book provides an unusually detailed look at the events and activities of individuals involved with a bankrupt organization whose two chief officers were convicted of wire and mail fraud. This book should be interesting to accounting academics, practitioners, and students. After reading the brief introductory chapter one may want to skim the detailed background of the Bakkers and their promotions in order to concentrate on the five chapters dealing with the business operations, the civil litigation, and the accounting firms. A detailed table of contents easily allows the reader to focus on particular areas or issues.

CAROL F. VENABLE
Associate Professor of Accounting

San Diego State University

G. D. TRITES et al., *Information to be Included in the Annual Report to Shareholders* (Toronto: The Canadian Institute of Chartered Accountants, 1991, pp. xvi, 298, \$39.50).

This research study is the result of the efforts of the Accounting Standards Committee of the Canadian Institute of Chartered Accountants "to discuss the objectives of the annual report to shareholders and to recommend what information should be provided, beyond that which must be presented in the financial statements, to assist in achieving those objectives" (p. v). The end product does a very good job of achieving the Institute's objective by presenting a very comprehensive overview of Canadian financial reporting requirements. Its almost outline format is a major advantage in that it contains considerable information in a relatively small number of pages. A large number of exhibits throughout the book are very helpful in highlighting major points.

The contents of the study are well organized and each chapter contains a concise conclusion which is supported by the contents of the chapter. The methodology used in the study surveys current practice and then reviews corporate legislation, regulatory requirements, authoritative pronouncements, and research literature. Early chapters discuss the objectives of annual reports and report users and their information needs. However, the major contribution of the study is in chapters 4 through 8 which present a framework for the annual report followed by a brief discussion of 47 different types of information to be included in the annual report. This information is presented under four major categories: Corporate Overview, Review of Operations, Financial Summary and Analysis, and Supplementary Information. A concluding chapter discusses the form and presentation of information in annual reports, including various alternative reporting formats. In this section, the study addresses what has become a concern of various parties—that there is too much fragmentation of information in annual reports. There is reference in this section to Summary Annual Reports which represent a relatively new form of corporate financial reporting. For anyone not familiar with Canadian financial reporting requirements, two appendices to the Study contain a survey of current practice in table format and an overview of legal reporting requirements.

In summary, the aim of the study is "to promote effective communication by providing helpful guidance for preparing comprehensive and integrated annual reports" (p. 1). The study does a good job of achieving this aim by identifying major deficiencies in annual reports and then presenting characteristics which would improve the report as a communications device.

JAMES A. GENTRY, JR.
Professor of Business Administration

Emory University

BOOKS RECEIVED JUNE 1, 1993 TO JULY 22, 1993

- AMERICAN PRODUCTIVITY & QUALITY CENTER, *The Benchmarking Management Guide* (Portland, OR: Productivity Press, Inc., 1993, pp. xxiii, 249, \$39.95).
R. BLANCHETTE et. al., *Audits of Non-Profit Organizations* (Toronto: The Canadian Institute of Chartered Accountants, 1993, pp. 88, \$19.50, paper).
RICHARD P. BRIEF, ed., *The Continuing Debate over Depreciation, Capital and Income* (New York: Garland Publishing, Inc., 1993, pp. xxv, 287, \$54.00).

- HARRY L. BROWN, *Design and Maintenance of Accounting Manuals*, 2nd ed., 1993, pp. 313).
- R. S. BUSKI et al., *Audit of the Allowance for Credit Losses* (Toronto: The Canadian Institute of Chartered Accountants, 1993, pp. 188, \$19.50, paper).
- MICHAEL CANGEMI, *Corporate Audit Department Procedures Manual* (New York: John Wiley & Sons, Inc., 1993, pp. xiv, 174, \$95.00, paper).
- WILLIAM F. CHRISTOPHER and CARL G. THOR, eds., *Handbook for Productivity Measurement and Improvement* (Cambridge, MA: Productivity Press, Inc., 1993, pp. xvii, 1344, \$90.00).
- JOHN RICHARD EDWARDS, *A History of Financial Accounting* (New York: Routledge, 1989, pp. 326).
- FEDERATION DES EXPERTS COMPTABLES EUROPEANS, 1992 *FEE Analysis of European Accounting and Disclosure Practices* (New York: Routledge, Chapman, and Hall, Inc., 1992, pp. x, 244, paper).
- DAVID A. R. FORRESTER, *Eugen Schmalenbach and German Business Economics* (New York: Garland Publishing, Inc., 1993, pp. 383, \$65.00).
- CARLA B. FURLONG, *Marketing for Keeps* (New York: John Wiley & Sons, Inc., 1993, pp. xii, 244, \$24.95).
- BOB GRAY, with JAN BEBBINGTON and DIANE WALTERS, *Accounting for the Environment* (New York: Markus Wiener Publishing, Inc., 1993, pp. xix, 348, \$39.95).
- S. J. GRAY, A. G. COENENBERG, and P. D. GORDON, eds., *International Group Accounting: Issues in European Harmonization* (London: Routledge, 1993, pp. xxvii, 435).
- RONALD J. LEWIS, *Activity-Based Costing for Marketing and Manufacturing* (Westport, CT: Quorum Books, 1993, pp. 238, \$59.95).
- RICHARD MACVE, with DAVID G. WILLIAM, *A Survey of Lloyd's Syndicate Accounts*, 2nd ed. (Hertfordshire, England: Simon & Schuster International Group, 1993, pp. xlvii, 396, \$80).
- W. M. McINNES, ed., *Auditing into the Twenty-First Century* (Edinburgh, Scotland: The Institute of Chartered Accountants in Scotland, 1993, pp. viii, 63, £12.50, paper).
- KENNETH S. MOST, *The Future of the Accounting Profession: A Global Perspective* (Westport, CT: Quorum Books, 1993, pp. xii, 224, \$55.00).
- J. B. RYAN, B. H. ANDREW, M. J. RAFFIKIN, and C. T. HEAZLEWOOD, *Australian Company Financial Reporting 1993* (Caulfield, Vic. Australia: Australian Accounting Research Foundation, 1993, pp. xxv, 347, \$40.00, paper).
- JOHN K. SHANK and VIJAY GOVINDARAJAN, *Strategic Cost Management: The New Tool for Competitive Advantage* (New York: The Free Press, 1993, pp. viii, 263, \$29.95, paper).
- G. A. SWANSON, *Macro Accounting and Modern Money Supplies* (Westport, CT: Quorum Books, 1993, pp. ix, 184, \$55.00).
- PAUL R. WATKINS and LANCE B. ELIOT, *Expert Systems in Business and Finance* (New York: John Wiley & Sons, Inc., 1993, pp. xxi, 367, \$49.95).
- JOHN C. WISDOM, *Checklists and Operating Forms for Small Businesses* (New York: John Wiley & Sons, Inc., 1993, pp. 475, \$95.00, paper).

EDITORIAL POLICY AND STYLE INFORMATION

EDITORIAL POLICY

According to the policies set by the Publications Committee (which were endorsed by the Executive Committee and were published in the *Accounting Education News*, June 1987), *The Accounting Review* "should be viewed as the premier journal for publishing articles reporting the results of accounting research and explaining and illustrating related research methodology. The scope of acceptable articles should embrace any research methodology and any accounting-related subject, as long as the articles meet the standards established for publication in the journal.... No special sections should be necessary. The primary, but not exclusive, audience should be—as it is now—academicians, graduate students, and others interested in accounting research."

The primary criterion for publication in *The Accounting Review* is the significance of the contribution an article makes to the literature.

The efficiency and effectiveness of the editorial review process is critically dependent upon the actions of both authors submitting papers and the reviewers. Authors accept the responsibility of preparing research papers at a level suitable for evaluation by independent reviewers. Such preparation, therefore, should include subjecting the manuscript to critique by colleagues and others and revising it accordingly prior to submission. The review process is not to be used as a means of obtaining feedback at early stages of developing the research.

Reviewers and associate editors are responsible for providing critically constructive and prompt evaluations of submitted research papers based on the significance of their contribution and on the rigor of analysis and presentation. Associate editors also make editorial recommendations to the editor.

MANUSCRIPT PREPARATION AND STYLE

The Accounting Review's manuscript preparation guidelines follow (with a slight modification) the B-format of the *Chicago Manual of Style* (13th ed.; University of Chicago Press). Another helpful guide to usage and style is *The Elements of Style*, by William Strunk, Jr., and E. B. White (Macmillan). Spelling follows Webster's International Dictionary.

FORMAT

1. All manuscripts should be typed on one side of 8½ × 11 good quality paper and be double spaced, except for indented quotations.
2. Manuscripts should be as concise as the subject and research method permit, generally not to exceed 7,000 words.
3. Margins of at least one inch from top, bottom, and sides should facilitate editing and duplication.
4. To assure anonymous review, authors should not identify themselves directly or indirectly in their papers. Single authors should not use the editorial "we."
5. A cover page should show the title of the paper, the author's name, title, and affiliation, any acknowledgments, and a footnote indicating whether the author would be willing to share the data (see last paragraph in this statement).

Pagination: All pages, including tables, appendices, and references, should be serially numbered. The first section of the paper should be untitled and unnumbered. Major sections may be numbered in roman numerals. Subsections should not be numbered.

Numbers: Spell out numbers from one to ten, except when used in tables and lists, and when used with mathematical, statistical, scientific, or technical units and quantities, such as distances, weights, and measures. For example: *three days*; *3 kilometers*; *30 years*. All other numbers are expressed numerically. Generally when using approximate terms spell out the number, for example, *approximately thirty years*.

Percentages and Decimal Fractions: In nontechnical copy use the word percent in the text; in technical copy the symbol % is used. (See the *Chicago Manual* for discussion of these usages.)

Hyphens: Use a hyphen to join unit modifiers or to clarify usage. For example: *a well-presented analysis*; *re-form*. See *Webster's* for correct usage.

Key Words: The synopsis is to be followed by four key words that will assist in indexing the paper.

SYNOPSIS

A synopsis of about 400 words should be presented on a separate page immediately preceding the text. The synopsis also serves as the "introduction." The synopsis should be nonmathematical and include a readable summary of the research question, method, and the significance of the findings and contribution. The title, but not the author's name or other identification designations, should appear on the synopsis page.

TABLES AND FIGURES

The author should note the following general requirements:

1. Each table and figure (graphic) should appear on a separate page and should be placed at the end of the text. Each should bear an Arabic number and a complete title indicating the exact contents of the table or figure.
2. A reference to each graphic should be made in the text.
3. The author should indicate by marginal notation where each graphic should be inserted in the text.
4. Graphics should be reasonably interpreted without reference to the text.
5. Source lines and notes should be included as necessary.

Equations: Equations should be numbered in parentheses flush with the right-hand margin.

DOCUMENTATION

Citations: Work cited should use the "author-date system" keyed to a list of works in the reference list (see below). Authors should make an effort to include the relevant page numbers in the cited works.

1. In the text, works are cited as follows: authors' last name and date, without comma, in parentheses: for example, (Jones 1987); with two authors: (Jones and Freeman 1973); with more than two: (Jones et al. 1985); with more than one source cited together (Jones 1987; Freeman 1986); with two or more works by one author: (Jones 1985, 1987).
2. Unless confusion would result, do not use "p." or "pp." before page numbers: for example, (Jones 1987, 115).
3. When the reference list contains more than one work of an author published in the same year, the suffix a, b, etc. follows the date in the text citation: for example, (Jones 1987a) or (Jones 1987a; Freeman 1985b).
4. If an author's name is mentioned in the text, it need not be repeated in the citation; for example, "Jones (1987, 115) says...."
5. Citations to institutional works should use acronyms or short titles where practicable; for example, (AAA ASOBAT 1966); (AICPA Cohen Commission Report 1977). Where brief, the full title of an institutional work might be shown in a citation: for example, (ICAEW The Corporate Report 1975).
6. If the manuscript refers to statutes, legal treatises, or court cases, citations acceptable in law reviews should be used.

Reference List: Every manuscript must include a list of references containing only those works cited. Each entry should contain all data necessary for unambiguous identification. With the author-date system, use the following format recommended by the *Chicago Manual*:

1. Arrange citations in alphabetical order according to surname of the first author or the name of the institution responsible for the citation.
2. Use author's initials instead of proper names.
3. Dates of publication should be placed immediately after author's name.
4. Titles of journals should not be abbreviated.
5. Multiple works by the same author(s) should be listed in chronological order of publication. Two or more works by the same author(s) in the same year are distinguished by letters after the date.
6. Inclusive page numbers are treated as recommended in *Chicago Manual* section 8.67.

Sample entries are as follows:

- American Accounting Association, Committee on Concepts and Standards for External Financial Reports. 1977. *Statement on Accounting Theory and Theory Acceptance*. Sarasota, FL: AAA.
- Demski, J. S., and D. E. M. Sappington. 1989. Hierarchical structure and responsibility accounting. *Journal of Accounting Research* 27 (Spring): 40–58.
- Dye, R., B. Balachandran, and R. Magee. 1989. Contingent fees for audit firms. Working paper. Northwestern University, Evanston, IL.
- Fabozzi, F., and I. Pollack, eds. 1987. *The Handbook of Fixed Income Securities*. 2d ed. Homewood, IL: Dow Jones-Irwin.
- Kahneman, D., P. Slovic, and A. Tversky, eds. 1982. *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge, United Kingdom: Cambridge University Press.
- Porcano, T. M. 1984a. Distributive justice and tax policy. *The Accounting Review* 59 (October): 619–36.
- _____. 1984b. The perceived effects of tax policy on corporate investment intentions. *The Journal of the American Taxation Association* 6 (Fall): 7–19.
- Shaw, W. H. 1985. Empirical evidence on the market impact of the safe harbor leasing law. Ph.D. dissertation, University of Texas, Austin.
- Sherman, T. M., ed. 1984. *Conceptual Framework for Financial Accounting*. Cambridge, MA: Harvard Business School.

Footnotes: Footnotes are not used for documentation. Textual footnotes should be used only for extensions and useful excursions of information that if included in the body of the text might disrupt its continuity. Footnotes should be double spaced and numbered consecutively throughout the manuscript with superscript Arabic numerals. Footnotes are placed at the end of the text.

SUBMISSION OF MANUSCRIPTS

Authors should note the following guidelines for submitting manuscripts:

1. Manuscripts currently under consideration by another journal or publisher should not be submitted. The author must state that the work is not submitted or published elsewhere.
2. In the case of manuscripts reporting on field surveys or experiments, four copies of the instrument (questionnaire, case, interview plan, or the like) should be submitted.
3. Four copies should be submitted together with a check in U.S. funds for \$50.00 for members or \$100.00 for nonmembers of the AAA made payable to the American Accounting Association. Effective January 1990, the submission fee is nonrefundable.
4. The author should retain a copy of the paper.
5. Revisions must be submitted within 12 months from request, otherwise they will be considered new submissions.

COMMENTS

Comments on articles previously published in *The Accounting Review* will be reviewed (anonymously) by two reviewers in sequence. The first reviewer will be the author of the original article being subjected to critique. If substance permits, a suitably revised comment will be sent to a second reviewer to determine its publishability in *The Accounting Review*. If a comment is accepted for publication, the original author will be invited to reply. All other editorial requirements, as enumerated above, also apply to proposed comments.

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POLICY ON DATA AVAILABILITY

The following policy has been adopted by the Executive Committee in its April 1989 meeting.

"An objective of (*The Accounting Review, Accounting Horizons, Issues in Accounting Education*) is to provide the widest possible dissemination of knowledge based on systematic scholarly inquiries into accounting as a field of professional research, and educational activity. As part of this process, authors are encouraged to make their data available for use by others in extending or replicating results reported in their articles. Authors of articles which report data dependent results should footnote the status of data availability and, when pertinent, this should be accompanied by information on how the data may be obtained."

**STATEMENT OF OWNERSHIP,
MANAGEMENT AND CIRCULATION** (Required by 39 U.S.C. 3685)

1. *Title of Publication:* The Accounting Review.

2. *Date of Filing:* October 6, 1993.

3. *Frequency of Issue:* Quarterly.

A. *No. of Issues published annually:* 4.

B. *Annual Subscription Price:* \$90.00.

4. *Location of known office of publication (street, city, county, state and ZIP code) (not printers):* 5717 Bessie Drive, Sarasota, Florida 34233-2399.

5. *Location of the headquarters of general business offices of the publishers (not printers):* 5717 Bessie Drive, Sarasota, Florida 34233-2399.

6. *Names and complete addresses of publisher, editor and managing editor.*

Publisher (name and address): American Accounting Association, 5717 Bessie Drive, Sarasota, Florida 34233-2399.

Editor: A. Rashad Abdel-khalik, Fisher School of Accounting, College of Business Administration, University of Florida, Gainesville, FL 32611.

Managing Editor (name and address): Paul Gerhardt, 5717 Bessie Drive, Sarasota, Florida 34233-2399.

7. *Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name*

and address, as well as that of each individual must be given.)

Name: American Accounting Association (A nonprofit educational association—no stockholders or "owners").

Address: 5717 Bessie Drive, Sarasota, Florida 34233-2399.

8. *Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state):* none.

9. *For completion by nonprofit organizations authorized to mail at special rates (Section 423.12 DMM only). The purpose, function and nonprofit status of this organization and the exempt status for federal income tax purposes:* Have not changed during preceding 12 months.

10. *Extent and nature of circulation:*

A. *Total no. copies printed (Net Press Run).* Average number copies each issue during preceding 12 months: 14,873. Actual number copies of single issue published nearest to filing date: 14,600.

B. *Paid Circulation:*

1. *Sales through dealers and carriers, street vendors and counter sales.* Average number copies each issue during preceding 12 months: 1,240. Actual number copies of single issue published nearest to filing date: 1,792.

2. *Mail subscriptions.* Average number copies each issue during preceding 12 months: 12,498. Actual number copies of single issue published nearest to filing date: 11,748.

C. *Total paid circulation (sum of*

10B1 and 10B2). Average number copies each issue during preceding 12 months: 13,738. Actual number copies of single issue published nearest to filing date: 13,540.

D. *Free distribution by mail, carrier or other means, samples, complimentary, and other free copies.* Average number copies each issue during preceding 12 months: 85. Actual number copies of single issue published nearest to filing date: 80.

E. *Total distribution (Sum of C and D).* Average number copies each issue during preceding 12 months: 13,823. Actual number copies of single issue published nearest to filing date: 13,620.

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G. *Total (Sum of E, F1 and 2—should equal net press run shown in A).* Average number copies each issue during preceding 12 months: 14,873. Actual number copies of single issue published nearest to filing date: 14,620.

H. *I certify that the statements made by me above are correct and complete.*

Paul L. Gerhardt, Executive Director.



JANUARY 1994 PLACEMENT ADS

The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The Review is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Review, 5717 Bessie Drive, Sarasota, FL 34233-2399. ATTENTION; ADVERTISING DEPT. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of \$150 per insertion. ADS SHOULD NOT EXCEED 150 WORDS.

- #101 THE UNIVERSITY OF NEBRASKA-LINCOLN, School of Accountancy anticipates one tenure-track position at the assistant professor rank for Fall 1994. Primary teaching interest should be Financial/Auditing. Candidates should have a doctorate or be near completion of their doctoral program. Professional certification is desirable. Applicants must have an interest in research and be willing to maintain an active involvement in our accounting programs at the undergraduate, master's and doctoral levels. Application deadline is February 14, 1994, or until a suitable candidate is found. Please send resume, dissertation proposal, and two letters of reference to: Dr. James E. Brown, Jr., Recruiting Coordinator, School of Accountancy, University of Nebraska-Lincoln, 357 College of Business Administration, Lincoln, NE 68588-0488. The University of Nebraska-Lincoln is committed to a pluralistic campus community through Affirmative Action and Equal Opportunity and is responsive to the needs of dual career couples. We assure reasonable accommodation under the Americans with Disabilities Act; contact Dr. Brown for information.
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- #104 Emory Business School seeks applicants for two faculty positions in accounting. Rank is open. Qualified applicants will possess a doctoral degree (or be close to completion) and evidence a strong commitment to both teaching and research. Salaries and research support are competitive. Applicants should send a vita to: Professor Grace Pownall, Accounting Area Coordinator, Emory Business School, 1602 Mizell Drive, Atlanta, GA 30322. Emory University is an Equal Opportunity, Affirmative Action employer. Applications from qualified minority and female candidates are strongly encouraged.

The Insurance Hypothesis and Market Prices

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SYNOPSIS AND INTRODUCTION: The literature on the audit market has suggested that a valued attribute of audits is implicit insurance. The insurance stems from the investor's right to recover from auditors the losses sustained by relying on audited financial statements that contain misrepresentations. This "insurance hypothesis" has proven difficult to test empirically, despite the widespread evidence of litigation against auditors. In this paper we provide some empirical support, showing that investors assign a value to the right to recover investment losses from the auditor.

We examine the effect on stock prices of Laventhol & Horwath (L&H) clients of two related events: first, the disclosure of their auditor's bankruptcy, and second, the appointment of a successor auditor. L&H's bankruptcy is a rare instance in which the insurance protection provided by the auditor was suddenly withdrawn and the ability of investors to recover losses from the auditor was significantly curtailed.

We argue that the value assigned by investors to the right to recover potential losses from the auditor is a component of the stock price, and hypothesize that it varies with the likelihood that the right will be exercised. It is expected to increase with increasing magnitude of stock price declines and to be greater for recent initial public offerings (IPOs) than for seasoned securities.

The results suggest that the disclosure of L&H's bankruptcy had an adverse effect on market prices of L&H clients. As hypothesized, the effect varied with previously incurred price declines, and was greater for IPOs. To more distinctly separate insurance and monitoring effects, we also examined the market reaction to clients' announcements of a replacement auditor. No significant reaction was observed, which is consistent with the insurance hypothesis.

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Overall, the results of the paper provide some empirical support for the theory that investors view the audit product as including insurance against potential investment losses.

Key Words: *Auditor litigation, Insurance hypothesis, Audit market.*

Data Availability: *Data used in this study will be made available upon request.*

THE remainder of the paper is structured as follows. Section I discusses the insurance hypothesis and reviews relevant issues related to auditor litigation. The likely effect on client stock prices of L&H's bankruptcy disclosure is also considered. Section II develops the hypotheses, outlines the research design and presents the results of the empirical tests. Section III contains the conclusions of this research.

I. The Insurance Hypothesis

Wallace (1987) and other studies (Chow et al. 1988; Schwartz and Menon 1985) have contended that audits provide investors a form of insurance. If an investor purchases seasoned securities on the basis of audited financial statements and subsequently sustains losses, and if some form of audit failure can be demonstrated, the law provides recourse for the investor against the auditor.¹ The auditor thus effectively functions as a potential (partial) indemnifier against investment losses. This line of reasoning is referred to as the "insurance hypothesis."

The high incidence of litigation against auditors provides an indication of investors' willingness to pursue the auditor for compensation in the event of losses. Auditors are sometimes viewed as having "deep pockets," which may provide incentives for plaintiffs to include them in class action lawsuits along with managers and other co-defendants (Kothari et al. 1988; Schipper 1991). The prevailing legal concept of joint and several liability provides an added motivation. Under this concept, any single defendant found guilty may be liable to pay all of the damages levied on all defendants combined, rather than a proportionate share based on the extent to which the particular defendant contributed to the problem.

In a recent position paper on litigation (Arthur Andersen et al. 1992), the Big 6 auditing firms indicate that the direct costs incurred by these firms for settling and defending lawsuits in 1991 amounted to \$477 million, or nine percent of their revenues. The position paper also indicates that claims against non-Big 6 firms rose by two-thirds from 1987 to 1991, and that there were about \$30 billion in damage claims facing the profession as a whole at the end of 1991.

Laventhol & Horwath's Bankruptcy

In November 1990, the partners of Laventhol & Horwath, the seventh largest accounting firm in the U.S., agreed to file for bankruptcy. The bankruptcy filing of L&H represented the largest failure of an accounting firm in the U.S. The major reason cited for L&H's demise was the large amount of settled and pending litigation against the firm's audit practice (*Business Week* 1990; Benoit 1991). According to L&H's chief executive, the litigation arose from the perception that the firm was a "deep pocket" rather than from poor professional performance (Arthur Andersen et al. 1992).

¹ In the case of registration statements, the burden of proof is on the auditor to demonstrate that due diligence was observed in the audit task.

In a typical auditor change situation, the investors continue to have rights against the predecessor auditor. However, when L&H filed for bankruptcy protection, investors in client firms were restricted from recovering any present and potential claims. Following L&H's bankruptcy announcement, the SEC required that corporate filings that included L&H-audited statements should carry cautionary announcements advising investors of the potential adverse effects of the L&H bankruptcy on rights to recover damages through litigation (SEC 1991).

If potential buyers of a client's securities rely on recovering damages from the auditor in the event of investment losses, the price of the security should include a component for the expected insurance coverage. Following L&H's bankruptcy, investors purchased securities without the auditor's insurance, so the price of the security should have adjusted to reflect the absence of coverage. Negative returns thus should be observed around the disclosure of L&H's bankruptcy for the population of L&H clients. This loss of insurance was not reversed simply by naming a replacement auditor, because the new auditor did not assume the liabilities of L&H. Investors could have a claim against the new auditor only when this auditor certified financial statements that subsequently were used for investment decisions.

The amount paid by an investor for the expected insurance coverage should depend on the likelihood that losses can be recovered from the auditor. Securities laws provide differential rights of recovery of damages from auditors to investors in seasoned securities and investors in IPOs. In general, the auditor's exposure is more restricted in the case of seasoned securities.

Seasoned Securities

For the investor in seasoned securities to have a claim against the auditor under the securities laws, the investor should sustain losses through actual reliance on audited financial statements that misrepresented the firm's true financial position.² Additionally, the auditor should have failed in the auditing task through gross negligence or fraud.

The essence of the investor's claim against the auditor in a suit related to a seasoned security is that misrepresentations in audited financial statements caused the market price to be higher than it would have been in the absence of misrepresentations, thereby inflating the purchase price for the investor. Further, the subsequent discovery of the misrepresentations resulted in the market price falling and the investor sustaining a loss (Kellogg 1984). Under the SEC's Rule 10(b)-5, the plaintiff's claim for damages is based on a loss computed as the difference between the purchase price and the price of the security immediately following the market's adjustment to the intervening disclosures of misrepresentations.

Since damages are based on the loss incurred from the time of purchase rather than the adjustment in stock prices following discovery of misrepresentations, there are incentives for investors to prosecute cases in which negative returns are experienced from purchase through post-disclosure adjustment (Kellogg 1984). On the other hand, an increase in price over the period between the purchase of the security and the post-disclosure adjustment generally provides little basis for damages, regardless of the nature of the misrepresentation.

Initial Public Offerings

The securities laws strongly assert the rights of IPO investors. In addition to the protection provided by Rule 10(b)-5, Section 11 of the Securities Act of 1933 provides the investor the right

²Under the "fraud on the market" legal theory, investors can argue that the price at which they purchased the security reflected all available information, including the financial statements in question, thus creating a link between the decision to purchase and the misrepresentations (Newkirk 1991).

to recover losses from the auditor associated with a securities offering. This protection was provided even if the investor did not rely on the registration statements in making the investment. The implied level of performance expected of the auditor also is higher in the case of IPOs, since the auditor is held liable for ordinary negligence, in addition to gross negligence and fraud.

The essence of the investor's claim is that material adverse information was not disclosed in registration documents or that the disclosed information was materially misstated. The burden of proof is on the auditor to show that due-diligence investigations were conducted.³ Since often it is not possible to ascertain nondisclosure from available information, plaintiffs can file suit to investigate whether there was a violation (Alexander 1991). Kraakman (1988) notes that Section 11 is "a truly draconian rule by the standards of ordinary tort doctrine," but contends that were the liability to be restricted here, the selling price of new securities would be lower.

The pool of potential litigants is not limited to the purchasers of the IPO. In IPO class action suits, the class is normally defined to include persons who purchased stock in the secondary market during the class period.⁴ The class period extends from the offering date to the date when plaintiffs claim the omitted information was fully revealed (Alexander 1991). Drake and Vetsuypens (1993) find that the mean class period for the IPO-related litigation cases in their sample is approximately 14 months.

Evidence suggests that investors in IPOs take advantage of the protection provided under the securities laws and file suit when they sustain investment losses. The asymmetric incentives observed by Kellogg (1984) hold for IPOs just as they do for seasoned securities. IPOs that lose value following the stock offering are more likely to have litigation. Alexander (1991) and Drake and Vetsuypens (1993) find that suits alleging securities law violations are routinely filed by IPO investors when there are significant post-offering stock price declines. The resulting litigation costs are heavy for the accounting firms. According to Berton (1992), post-IPO litigation problems are so significant that some small CPA firms now are staying away from IPO audit.⁵

An indication of the importance of legal rights against auditors in connection with registration statements is provided by the SEC's (1991) directive (Staff Accounting Bulletin no. 90) that any L&H-audited prospectus filed after the bankruptcy date should carry a warning in several places, including the top margin of the cover page ("clearly highlighted and set off from other disclosure"), advising investors of the limiting effect of the bankruptcy filing on investors' rights. The prospectus also was required to contain a detailed discussion of the effect of the L&H bankruptcy on investors.⁶

³Tinic (1988) points out that the regulations, by necessity, are vague on the details of the standards for due-diligence investigations. What might be omitted from disclosure as being immaterial may be judged later to be material.

⁴According to securities regulations, investors in the secondary market need not show reliance on the registration statements in order to have a claim against the auditor unless post-IPO financial statements (covering a 12-month period following the offering) were issued prior to their purchase.

⁵Alexander (1991) notes that CPA firms view the reputational effects seriously and frequently choose to litigate rather than settle out of court. In contrast, Palmrose (1991) finds a low trial rate for IPOs in her sample.

⁶For example, the Sbarro Company's S-3 registration statement in March 1991 carries a lengthy discussion of the L&H bankruptcy, including the limitations imposed on investor litigation by the bankruptcy code, the legal implications of L&H being a general partnership, and a recommendation that the investor should consult with his or her counsel on the effect of the L&H bankruptcy on an investment in the company. The company also indicates that it believes L&H's audit report to be correct and accurate, and that the officers and directors would be entitled to rely on L&H as an expert for purposes of maintaining a due-diligence defense against any action brought under the 1933 Act. Less prominent warnings were required for corporate filings other than registration statements.

Alternative Hypotheses

Alternative hypotheses, other than insurance, may explain security price changes observed at the time of L&H's bankruptcy disclosure. The most prominent of these is related to monitoring. The primary function of the audit is derived from monitoring needs. Information asymmetries between owners and managers make it necessary to develop monitoring mechanisms to ensure that managers act in accordance with owners' interests. The independent audit provides assurance that manager-prepared reports do not contain misrepresentations.

When L&H announced bankruptcy, two types of monitoring uncertainties were created. First, there was uncertainty introduced about the quality of future monitoring. Second, for firms with upcoming fiscal year-ends, there was the prospect of a delay in the filing of audited financial statements.

Recent studies have suggested that auditors have differing levels of credibility (e.g., Simunic and Stein 1987). More credible auditors are believed to supply higher quality monitoring. It has been shown that investors and other users react favorably to the selection of auditors perceived as having high quality (Beatty 1989; Eichenseher et al. 1989).

When L&H declared bankruptcy, the quality of the successor auditor was unknown. This monitoring uncertainty plausibly could have resulted in an adverse effect on client firm stock prices at the time of the bankruptcy disclosure if investors generally anticipated a decline in the quality of monitoring, and a favorable effect if investors expected improvement in monitoring. The uncertainty would have been resolved upon the appointment of the successor, at which time the price would have increased or decreased, depending on the quality of the successor auditor.

Another monitoring-related hypothesis not considered here is that investors in L&H clients revised their assessment of the quality of past L&H monitoring when the bankruptcy was announced. This hypothesis is plausible only if new information about L&H's monitoring capabilities was conveyed by the announcement. There is no reason to believe that this was the case. L&H's litigation problems had received prominent media attention (e.g., Berton 1990a, 1990b), and the bankruptcy disclosure itself did not provide any additional information on this issue.⁷

The prospect of a delay in obtaining audited financial statements for the current fiscal year also may have had a negative effect on stock prices. The clients most affected by L&H's exit in this regard are likely to have been those that were in the final stages of preparing audited financial statements at the time of L&H's bankruptcy. The SEC (1991) subsequently permitted clients with fiscal year-ends between August 31 and November 30, 1990, to file timely unaudited statements for the current fiscal year, to be followed with a subsequent filing of an audited statement.

Another explanation for an adverse market reaction to L&H's bankruptcy may be provided by audit fees. Auditors incur substantial initial costs for new clients, and benefit from experience in auditing the same client over time (DeAngelo 1981). A client who changes auditors may incur an increase in audit fees. In theory, the likelihood of higher audit fees should result in a cross-sectional decline in stock prices of L&H clients, unless it is anticipated that audit cost savings could result from low-ball bids. It is questionable, however, whether changes in audit costs would be large enough to have a detectable effect on stock prices.

Our empirical tests focus on the insurance hypothesis. In designing the tests, we attempt to consider the alternative hypotheses developed in this section by using appropriate control variables where possible.

⁷ Some evidence in this respect is reported in note 11. There was no significant adverse reaction to earlier announcements of L&H's litigation and other problems, which is inconsistent with a market reassessment of L&H's monitoring capabilities on those dates.

II. Hypotheses and Tests

Hypotheses

Let the value assigned by investors in L&H's clients to the expected insurance coverage provided by the auditor be i . The announcement of the auditor's bankruptcy should result in the loss of this coverage since it curtailed the right to recover losses from the auditor. Security prices should then decline by i .

H1: L&H clients' security prices declined relative to the market on the disclosure of L&H's bankruptcy.

The magnitude of i is expected to vary from client to client, depending upon the likelihood that the investor subsequently will be involved in a class action lawsuit to recover potential investment losses from the auditor. Since investors in securities that have experienced price declines are more likely to initiate class action lawsuits, i is expected to be greater for these securities and to increase with the magnitude of the sustained losses.⁸

H2: L&H clients whose securities sustained recent losses experienced more negative abnormal returns on the disclosure of L&H's bankruptcy than other L&H clients, and these returns were correlated with the magnitude of the previously sustained losses.

The special protection provided under securities laws to investors in IPOs makes it likely that the value of i for these securities is higher than for seasoned stocks. As in the case of seasoned stocks, the magnitude of i should increase with the loss sustained by the security.

H3: For L&H clients whose securities sustained recent losses, IPO clients experienced more negative abnormal returns on the disclosure of L&H's bankruptcy than L&H clients with seasoned securities.

Empirically, if cross-sectional negative abnormal returns are observed on the disclosure of L&H's bankruptcy, Hypothesis 1 would be supported. This finding would be consistent with the insurance hypothesis, but also would be consistent with the other explanations presented earlier. If abnormal returns are associated with losses incurred by seasoned securities and IPOs in the bankruptcy period, and if more negative abnormal returns are associated with IPO losses, Hypotheses 2 and 3 would be supported.

It still is possible, however, that losses sustained by seasoned firms and IPOs are significantly associated with the disclosure-related returns because they are surrogates for monitoring uncertainties. This would be the case if investors in poorly performing firms anticipate a credibility-decreasing auditor replacement upon L&H's exit. To eliminate the possibility that the variables of interest are surrogates for monitoring uncertainties rather than for insurance, we consider the market's reaction to the appointment of a successor auditor to L&H.

The value of the expected insurance coverage, i , is not recovered upon the appointment of a replacement, since the successor auditor does not assume the liabilities of the predecessor auditor. However, the appointment of the new auditor should resolve the uncertainties related to future monitoring quality, resulting in a post-appointment price increase or decrease. If investors previously lowered the value of poorly performing IPOs and seasoned securities because of

⁸For the empirical tests we define firms with previously sustained losses as those whose stock prices declined between November 21, 1989 and November 20, 1990, the day of L&H's bankruptcy announcement.

monitoring concerns rather than insurance concerns, then these firms should experience corresponding price increases upon the favorable resolution of the monitoring uncertainties. On the other hand, if insurance needs drive the market's reaction to the bankruptcy disclosure, then the appointment of a new auditor should not result in positive returns for these firms.

Sample Selection

The hypotheses were tested using different samples. To test Hypothesis 1, a sample representing all publicly traded U.S. companies was used. Hypotheses 2 and 3 were tested on a sample of publicly traded companies audited only by L&H.

In order to be included in the sample, a firm had to meet all the following criteria: first, the firm should have had stock return data on the CRSP tapes;⁹ second, additional data required in the analysis (e.g., on the firm's auditor) should have been available; third, the trading price should have been at least \$0.25; fourth, the firm should not have made a dividend or earnings announcement on the day (or days) for which the return is computed or during the three trading days preceding or following the day.

The first and second criteria were necessary to meet the complete data requirement, the third criterion was used to reduce the effect of outlier returns that are generated from low value stock, the fourth criterion reduced the effect of confounding events. Additionally, ADRs and investment funds with multiple listings were deleted. The nine firms audited by the firm Spicer and Oppenheim also were excluded from the sample, to remove potential confounding effects.¹⁰

Event Window

In selecting the bankruptcy event window, we considered the sequence of events related to the dissemination of the news of L&H's bankruptcy. The decision to liquidate was taken in Houston late on Saturday, November 17, 1990, when the partners rejected a recapitalization plan. From all accounts, this decision was unexpected. According to *Business Week*, for example, "few partners heading for the Houston meeting suspected—or sought—what occurred" (*Business Week* 1990). L&H had strongly condemned speculation about the firm's imminent collapse as groundless rumors as late as a week prior to the decision to close (Cohen 1990). The first news report of the decision to liquidate appears to have been on Monday, November 19, 1990, when *The New York Times* carried a story, unconfirmed by L&H or L&H partners, that the firm had decided to liquidate (Cowan 1990). The next day, the news was more widely disseminated by *The Wall Street Journal* (Pae 1990) and other newspapers. The event window was determined to be the two-day period November 19-20, 1990.¹¹

⁹ We added six L&H firms for which data were available on the S&P Daily Stock Price Record for the required trading days.

¹⁰ The November 20, 1990 *Wall Street Journal* article reporting L&H's bankruptcy decision also reported that Spicer and Oppenheim, the country's 13th largest accounting firm, was facing financial problems. Later that month, the dissolution of Spicer and Oppenheim was announced. Since doubts about the longevity of Spicer and Oppenheim may have been induced by the L&H announcement, this firm's nine publicly traded companies were excluded from the analysis.

¹¹ On November 16, the *Chicago Tribune* reported that some L&H partners favored dissolving the firm, but that additional financing from bankers could be on its way, forestalling the need for such a decision (Cohen 1990). Table 2 shows that there were no significant negative returns for L&H clients on that day. Earlier in 1990, two articles in *The Wall Street Journal* (Berton 1990a; 1990b) discussed L&H's financial woes extensively. However, there did not seem to be a suggestion that the firm would go bankrupt. We computed excess returns for May 14 and May 17, the days the stories appeared. The mean return for L&H clients was not significantly different from the mean return for non-L&H clients on either day, or for the entire four-day period May 14-17.

Hypotheses Tests

To test Hypothesis 1, cumulative abnormal market returns (CARs) were determined over November 19-20 for all firms in the sample. Non-L&H clients in the sample consisted of 4,523 firms that met the criteria listed earlier. From the original sample of 127 L&H-audited firms for which data on returns were available, 15 were eliminated because of earnings announcements within three days of the event window, four were eliminated because of dividend announcements, and 8 did not meet the minimum stock price criterion.¹² The remaining 100 L&H clients were included in the sample.

L&H-audited firms were smaller, on average, than firms audited by all other CPAs, with a mean market value of common stock of \$77.9 million versus \$895.9 million. The L&H sample was well-diversified, representing 78 different industries (as classified by their four-digit SIC codes). The largest industry representations were from pharmaceuticals (five firms) and restaurants (four firms).

L&H firms which made their initial stock offering between July 1, 1989, and November 19, 1990 were classified as IPOs for the purpose of this study.¹³ Eleven firms met this criterion. The mean age from the time of the IPO for these firms was 11.7 months. The July 1 cut-off results in a 17-month inclusion period, which is slightly longer than the 14-month mean class period for IPO-related litigation identified by Drake and Vetsuypens (1993).

CARs were computed by using the market model to generate expected stock returns for each day in the event window.¹⁴ In the L&H sample, the mean CAR for IPOs was -0.0489 (standard deviation = 0.063), while the mean CAR for seasoned securities was -0.0154 (standard deviation = 0.063). L&H firms as a whole had a mean abnormal return of -0.0191 (standard deviation = 0.063), which was significantly different from zero (t -value = -3.01, p = 0.003).

Table 1 compares CARs for L&H clients with CARs for all other firms that met our sample criteria. Returns for L&H clients were significantly more negative (mean returns approximately 2.5 percent lower) than for other firms, supporting Hypothesis 1. Returns for seasoned L&H clients and IPO L&H clients also show significant negative returns when compared to the corresponding firms associated with non-L&H auditors.

Table 2 shows daily excess returns for L&H and non-L&H firms over the ten days surrounding the bankruptcy disclosure, that is, from the fourth trading day preceding the event window to the fourth trading day following it. It can be seen that while L&H firms underperformed non-L&H firms, on average, for two of the four days preceding the event window and for three of the four days following it, the only significant differences observed are on November 19 and November 20, with the largest difference (about 1.5 percent) being observed on November 20. November 20 was the only day on which the L&H return was significantly different from zero (t = -2.30, p = 0.023).

To test Hypotheses 2 and 3 we used a regression model which included independent variables intended to control for monitoring uncertainties. The hypotheses were tested on the sample of L&H client securities using the following regression model.

¹² Auditor data were gathered from the Compact Disclosure, *Who Audits America*, and Compustat data bases. We excluded firms that had switched away from L&H since the last published annual report. Interestingly, of the firms identified by *Public Accounting Report* in 1990 as L&H's 50 top public clients (*Public Accounting Report* 1990), only 27 appear in our sample. Some clients were lost as a consequence of merger (3) or bankruptcy (6), a few switched auditors (3), and many were delisted (11).

¹³ Offering dates were identified from *Going Public: The IPO Reporter* and the S&P Corporation Record.

¹⁴ Betas were estimated using a 100-day estimation period that ended November 5, 1990. In computing market returns, the equal-weighted NYSE/AMS or NASDAQ index was used, depending on the exchange listing of the firm.

Table 1
Effect of L&H Bankruptcy on Security Prices of L&H Clients—CARs for Disclosure
Period (November 19-20, 1990)^a

	<i>L&H Clients</i>		<i>Other Firms</i>		<i>t</i>	<i>p</i>
	<i>n</i>	<i>Mean</i> (<i>Std. devn.</i>)	<i>n</i>	<i>Mean</i> (<i>Std. devn.</i>)		
<i>A. All Firms</i>	100	-0.0191 (0.063)	4,523	0.0057 (0.074)	3.86	0.001
<i>B. Seasoned Firms Only</i>	89	-0.0154 (0.063)	4,106	0.0016 (0.068)	2.34	0.019
<i>C. IPO Firms Only^b</i>	11	-0.0489 (0.063)	417	0.0462 (0.111)	2.83	0.005

^aThis table shows the mean cumulative abnormal return for the sample of L&H clients and non-L&H clients over the two trading days included in the event window (November 19-20, 1990). The probability shown is for a two-tailed t-test. Panels B and C break up the sample into firms with seasoned securities and firms classified as IPOs.

^bThe small number of IPOs in the L&H sample may make the t-test inappropriate. A Wilcoxon rank sums test also was conducted, and essentially the same result obtained ($z = -2.96$, $p = 0.003$).

$$\text{RETURN1} = b_0 + b_1 \text{SSLOSS} + b_2 \text{IPOLOSS} + b_3 \text{MVALUE} + b_4 \text{FYR} + e$$

where:

RETURN1 = the CAR over the two-day window,
 SSLOSS = the loss experienced by seasoned stocks,
 IPOLOSS = the loss experienced by IPOs,
 MVALUE = the log of the market value of the firm's stock on November 16, 1990, and
 FYR = the fiscal year-end, coded as 1 if between August 31 and November 30, and as 0 otherwise.

The variable SSLOSS was included in the model to test Hypothesis 2. Firms that were not classified as being IPOs were included in the seasoned securities group. For these firms, SSLOSS took the value of the percentage change in stock prices since November 21, 1989, if stock prices declined, and the value zero if stock prices increased, over this time period. IPOs also were assigned a zero value for this variable. There were 63 seasoned securities that experienced a price decline over this 12-month period.¹⁵

The variable IPOLOSS was included in the model to test Hypotheses 2 and 3. For IPOs whose prices had declined from the offering date to November 16, 1990, IPOLOSS was assigned the value of the percentage decline. IPOLOSS was constructed to be zero for IPOs with positive

¹⁵The high proportion of stocks that lost value over the year is not surprising. The market generally declined over this period. The NASDAQ composite index, for example, dropped by about 22 percent.

Table 2
Effect of L&H Bankruptcy on Security Prices of L&H Clients—Abnormal Returns for
Ten Days Around Disclosure Period^a

<i>Date</i>	<i>L&H Clients</i>		<i>Other Firms</i>		<i>t</i>	<i>p</i>
	<i>n</i>	<i>Mean (Std. devn.)</i>	<i>n</i>	<i>Mean (Std. devn.)</i>		
11/13	98	0.0063 (0.057)	4,333	0.0024 (0.072)	-0.54	0.590
11/14	99	-0.0064 (0.058)	4,444	0.0014 (0.056)	1.37	0.170
11/15	100	0.0006 (0.055)	4,538	-0.0002 (0.055)	-0.13	0.891
11/16	102	-0.0036 (0.048)	4,539	0.0022 (0.056)	1.20	0.232
11/19	100	-0.0064 (0.044)	4,523	0.0035 (0.057)	2.22	0.028
11/20	100	-0.0127 (0.054)	4,523	0.0023 (0.057)	2.57	0.010
11/21	100	0.0066 (0.058)	4,654	0.0001 (0.056)	-1.16	0.247
11/23	103	-0.0055 (0.049)	4,764	-0.0010 (0.051)	0.87	0.380
11/26	102	-0.0025 (0.060)	4,750	0.0016 (0.055)	0.46	0.458
11/27	100	-0.0069 (0.061)	4,718	0.0022 (0.057)	1.59	0.112

^aThis table shows the mean daily abnormal return for L&H clients and non-L&H clients in the four trading days before, the four trading days after, and the two days included in the event window (November 19-20, 1990). T-tests were performed for differences between the L&H and non-L&H sample means. Probabilities are shown for two-tailed tests. Sample sizes vary for each day because the selection criterion to eliminate confounding dividend and earnings announcements excluded different sets of firms.

returns over this period, and for seasoned securities. IPOLOSS was used, rather than a dummy variable indicating whether the firm is classified as an IPO, since the likelihood of litigation, and thus the level of insurance lost, increases with the loss sustained by the investors. The sample for this analysis included 11 IPOs with price declines since the offering date.

If Hypothesis 2 is correct, firms that experienced stock price declines would be likely to have more negative returns on the bankruptcy disclosure than other firms. The mean return for firms with previously sustained losses was -0.0280, while the other L&H firms had a positive mean return of 0.0049, a significant difference (t -value = 3.10, p = 0.003). In the regression, variables SSLOSS and IPOLOSS were expected to have positive coefficients, b_1 and b_2 . If Hypothesis 3

holds, the effect of losing the right to recover losses from L&H should be more pronounced in IPOs than in seasoned securities. This should lead b_2 to be significantly greater than b_1 .

Since excess returns may be related to size (Fama and French, 1992), MVALUE was used as a control measure of size. One effect that the size variable should pick up is the increase in audit costs, given that prior literature shows that audit fees are a function of size (e.g., Maher et al. 1992). This effect should lead to the coefficient b_3 being negative. However, size may surrogate for other effects as well.

FYR (fiscal year-end) controls for monitoring uncertainties resulting from the possibility of lengthy delays before audited statements for the period were issued. The cut-offs of August 31 and November 30, 1990, were selected because, as indicated earlier, the SEC allowed clients with fiscal year-ends between these dates to file unaudited statements. FYR was expected to have a negative coefficient.¹⁶

Table 3 shows simple correlations for the independent variables in the model. Following from the construction of the variables, SSLOSS and IPOLOSS were significantly correlated and, as might be expected, SSLOSS and MVALUE were correlated. We computed variance inflation factors and condition indices as diagnostics for multicollinearity in the regression. These indicators were well within an acceptable range.¹⁷

Table 4 presents the results of the regression using a two-day window for the dependent variable, alongside results using three- and five-day windows around the November 19, 1990 bankruptcy disclosure date. The model for the two-day window was significant. IPOLOSS and SSLOSS were both significant, in the expected direction, supporting Hypothesis 2, while the control variables MVALUE and FYR were not.¹⁸ We used a t-test to test for a difference between b_2 and b_1 . The difference was significant and in the expected direction (t-value = 2.00, $p = 0.048$), supporting Hypothesis 3. As might be expected, given the apparently unexpected nature of L&H's disclosure and the pattern of daily returns observed in Table 2, the models for the longer windows had less explanatory power, with the five-day window model having a negative adjusted R^2 . IPOLOSS was significant with the three-day window but not with the five-day window, while the other variables were not significant in any of the regressions.¹⁹

Appointment of Successor Auditor

In the previous analysis, IPOLOSS and SSLOSS may be surrogates for expected deterioration in monitoring quality, rather than for insurance-related variables. To investigate this more

¹⁶One firm that fell between our cut-off dates but had already issued audited financial statements by November 19 was assigned a value of 0 rather than 1. We also reran the regression with an alternative definition of FYR, changing cut-off dates to include only firms whose fiscal year was over and who were probably in the middle of their annual audit (i.e., reclassifying November 30 year-ending firms into the FYR = 0 class). The results were essentially the same as those reported here.

¹⁷The variance inflation factors obtained were under 2 and condition indices were under 6. Kennedy (1985, 153) indicates that rule-of-thumb threshold levels are 10 for the variance inflation factors and 30 for condition indices.

¹⁸When a dummy variable, IPODUM, set at 1 if the firm is an IPO, and 0 otherwise, was added to the model, it was not significant. However, IPOLOSS continued to be significant. We also considered the sensitivity of our choice of cut-off period for classifying a firm as a recent IPO. As the cut-off period goes further back (up to 29 months from the existing 17 months) the number of firms classified as IPOs goes up, but the likelihood that they will truly be treated as IPOs in litigation goes down. We reran regressions with different cut-off dates up to 29 months. The effect in terms of regression statistics was a decline in the t-statistic for the IPOLOSS variable, though it continued to be significant ($p = 0.01$). The coefficients for the other variables were stable.

¹⁹Event studies that use cross-sectional returns data from the same calendar time period potentially suffer from the problem of cross-sectional dependence in residuals. To compensate for this problem, we estimated the bias in the t-values for the coefficient tests, and adjusted the reported t-values for this bias, following the procedure suggested by Bernard (1987). The results remained essentially unchanged from those reported here. This is consistent with the expectation that the cross-sectional dependence problem is not significant for studies using daily or weekly returns (e.g., Bernard 1987).

Table 3
Correlation Matrix^a

	SSLOSS	IPOLOSS	MVALUE	FYR
SSLOSS	1.00 (0.00)	-0.28 (0.01)	0.20 (0.05)	-0.14 (0.15)
IPOLOSS		1.00 (0.00)	0.15 (0.15)	-0.04 (0.69)
MVALUE			1.00 (0.00)	-0.09 (0.35)
FYR				1.00 (0.00)

^a The sample consists of 100 L&H clients who met the selection criteria described in the paper and are included in the regression results reported in Table 4. The table provides Pearson correlation coefficients, with probability levels in parentheses. SSLOSS = the loss experienced by seasoned securities, IPOLOSS = the loss experienced by IPOs, MVALUE = the log of the market value of the firm's stock, FYR = a dummy variable representing the fiscal year-end.

completely, the market reaction to the announcement of the successor auditor was considered. The appointment of the successor auditor should have resolved the uncertainty about future monitoring quality.

The sample for this analysis was slightly different from the L&H client firm sample used in the previous analysis because of the exclusion of a different set of firms for confounding dividend and earnings announcements and other reasons.²⁰ There were 107 firms in the sample, including 12 IPOs. Successor auditor appointment dates for these firms were obtained from public announcements and Form 8-K filings. For 23 of the 107 firms, the 8-Ks did not identify an appointment date, and the 8-K filing date was used instead.

Abnormal returns were determined for each firm for three days (-1 to +1) and five days (-2 to +2) around the appointment date for the successor auditor. The mean return should be positive (negative) if the new auditor, on average, was a more (less) credible auditor than expected. The mean abnormal return for the three-day window was -0.007 (standard deviation = 0.083), which was not significantly different from zero ($t = -0.93$, $p = 0.36$). The five-day return was also negative (mean = -0.004, standard deviation = 0.101) and not significant ($t = -0.42$, $p = 0.67$).

The regression model employed used the same independent variables as in the first regression, with the addition of a variable representing the type of successor auditor.

²⁰From the available set of 127 L&H firms, 7 were deleted because of confounding earnings announcements, 2 because of dividend announcements, 6 because the stock price was less than \$0.25, and 5 because no 8-K filing or media announcement disclosing the new auditor's appointment could be located. One additional firm was deleted because of a confounding earnings announcement in doing the five-day tests.

Table 4
Effect of L&H Bankruptcy on Security Prices of L&H Clients—Regression
of Abnormal Returns on Firm-Specific Factors^a

Variable	Two-day Window		Three-day Window		Five-day Window	
	Coefficient (St. err.)	t-value (prob.)	Coefficient (St. err.)	t-value (prob.)	Coefficient (St. err.)	t-value (prob.)
INTERCEPT	-0.012 (0.015)	-0.776 (0.439)	-0.019 (0.019)	-1.010 (0.315)	-0.014 (0.024)	-0.564 (0.574)
SSLOSS	0.051 (0.023)	2.223 (0.029)	0.036 (0.028)	1.299 (0.197)	0.018 (0.037)	0.501 (0.617)
IPOLOSS	0.127 (0.039)	3.261 (0.002)	0.127 (0.047)	2.715 (0.008)	0.013 (0.066)	0.204 (0.839)
MVALUE	0.004 (0.004)	0.853 (0.396)	0.004 (0.005)	0.789 (0.432)	0.001 (0.006)	0.134 (0.894)
FYR	0.023 (0.015)	1.493 (0.139)	0.014 (0.018)	0.776 (0.440)	-0.006 (0.024)	-0.260 (0.796)
Adjusted R ²	0.111		0.057		-0.042	
F-value	4.090		2.458		0.122	
Probability	0.004		0.051		0.974	

^a The table shows OLS regression results for three different windows for the model $RETURN1 = b_0 + b_1SSLOSS + b_2IPOLOSS + b_3MVALUE + b_4FYR + e$. The sample consists of 100 L&H clients for the two-day window (0, +1), 98 for the three-day window (-1 to +1), and 89 for the five-day window (-2 to +2). RETURN1 = the cumulative abnormal return related to L&H's bankruptcy disclosure, SSLOSS = the loss experienced by seasoned securities, IPOLOSS = the loss experienced by IPOs, MVALUE = the log of the market value of the firm's stock, FYR = a dummy variable representing the fiscal year-end.

$$RETURN2 = b_0 + b_1SSLOSS + b_2IPOLOSS + b_3MVALUE + b_4FYR + b_5CPATYPE + e$$

where:

RETURN2 = the CAR for the former L&H client over the three (five) days around the successor auditor appointment date,

SSLOSS = the loss experienced by investors in seasoned stocks, as defined earlier,

IPOLOSS = the loss experienced by investors in firms that were IPOs, as defined earlier,

MVALUE = the market value of the firm, as defined earlier,

FYR = a dummy variable representing the fiscal year-end, as defined earlier, and

CPATYPE = a dummy variable representing the category of the successor auditor, coded as 1 if the successor was a Big 6 CPA and as 0 otherwise.

If variables SSLOSS and IPOLOSS were significantly associated with abnormal returns at the time of L&H's bankruptcy disclosure due to monitoring rather than insurance reasons, then

Table 5
Effect of Appointment of Successor Auditor on Security Prices of Former L&H
Clients—Regression of Abnormal Returns on Firm-Specific Factors^a

Variable	Three-day Window		Five-day Window	
	Coefficient (Std. error)	t-value (prob.)	Coefficient (Std. error)	t-value (prob.)
INTERCEPT	-0.020 (0.021)	-0.938 (0.351)	0.005 (0.025)	0.193 (0.847)
SSLOSS	0.040 (0.033)	1.222 (0.225)	0.050 (0.038)	1.303 (0.196)
IPOLOSS	0.031 (0.055)	0.573 (0.568)	0.107 (0.064)	1.682 (0.096)
MVALUE	-0.001 (0.006)	-0.244 (0.807)	-0.002 (0.007)	-0.262 (0.794)
FYR	-0.006 (0.023)	-0.263 (0.793)	-0.024 (0.027)	-0.891 (0.375)
CPATYPE	0.049 (0.018)	2.714 (0.008)	0.029 (0.021)	1.376 (0.172)
Adjusted R ²	0.041		0.023	
F-value	1.906		1.489	
Probability	0.099		0.199	

^a The table shows OLS regression results for two different windows for the model $RETURN2 = b_0 + b_1SSLOSS + b_2IPOLOSS + b_3MVALUE + b_4FYR + b_5CPATYPE + e$. The sample consists of 107 former L&H clients for the three-day window (-1 to +1) and 106 former clients for the five-day window (-2 to +2). RETURN2 = the cumulative abnormal return related to the appointment of the new auditor, SSLOSS = the loss experienced by seasoned securities, IPOLOSS = the loss experienced by IPOs, MVALUE = the log of the market value of the firm's stock, FYR = a dummy variable representing the fiscal year end, and CPATYPE = a dummy variable representing the type of auditor.

coefficients b_1 and b_2 should be negative and significant in this analysis. MVALUE and FYR were included as control variables, as before.

CPATYPE was introduced in this regression because prior studies have found evidence that auditor switches resulting in more (less) reputable auditors being appointed had a positive (negative) effect on the market (e.g., Eichenseher et al. 1989). In view of L&H's size, changes from L&H to Big 6 CPA firms were viewed as being credibility-increasing, while changes to non-Big 6 firms were viewed as being credibility-decreasing. In this sample, 66 clients chose Big 6 auditors. The coefficient for CPATYPE was expected to be positive.

The results of the regression are shown in table 5.²¹ Regression results for three- and five-day windows are shown. The model was not significant for the five-day window and was marginally

²¹ Simple correlations for the five independent variables reveal significance only between SSLOSS and IPOLOSS, as in Table 3 (correlation coefficient = -0.28, $p = 0.002$), and MVALUE and CPATYPE (Pearson's correlation coefficient = 0.269, $p = 0.005$). In the sample of 107 firms, 66 selected a Big 6 auditor to succeed L&H and these firms had larger market values than the firms that selected a non-Big 6 auditor. Diagnostics for multicollinearity were computed and were well within an acceptable range; variance inflation factors were less than 2 and condition indices were less than 5.

significant for the three-day window. CPATYPE, with a positive coefficient, was significant in the shorter window, suggesting a more favorable reaction from the market when firms formerly audited by L&H chose Big 6 auditors than when they selected non-Big 6 auditors. This result is consistent with prior studies. The variables SSLOSS and IPOLOSS had positive coefficients, generally not significant at conventional levels, which suggests that the results observed in table 4 may be attributed to insurance rather than monitoring.²²

In general, the results of this analysis suggest that the price reactions observed at the disclosure of L&H's bankruptcy are attributable to the absence of the expected insurance coverage, *i*, rather than to problems of monitoring introduced by the bankruptcy of the auditor.

III. Conclusion

This paper provides some empirical tests of the insurance hypothesis of auditing. The disclosure of L&H's bankruptcy was found to have a negative impact on L&H client stock prices. There was no corresponding increase in stock prices on announcement of a replacement auditor. The value of the expected insurance coverage, *i*, included in the price of the stock, was hypothesized to vary with the magnitude of losses previously sustained by the security and with the security's classification either as an IPO or as a seasoned security. These hypotheses were supported empirically.

Overall, the results of the paper suggest that auditors are viewed by investors as guarantors of financial statements, and in a sense, as guarantors of investments. Investors appear to be willing to pay a premium for the right to recover potential investment losses from auditors through litigation. These findings have important implications. For example, it appears to be important for auditors to price their product to reflect this insurance service. This may require the development of skills in assessing the riskiness of a client from the viewpoint of potential litigation. From the policy standpoint, it is important to consider whether the financial disclosure system is best served by having the auditor serve as an indemnifier of investment losses in this manner. In time, this may result in auditors staying away from certain kinds of clients, or raising prices for risky clients to a level that clients find unaffordable.

References

- Alexander, J. 1991. Do the merits matter? A study of settlements in securities class actions. *Stanford Law Review* 43 (February): 498-598.
- Arthur Andersen & Co., Coopers & Lybrand, Deloitte & Touche, Ernst & Young, KPMG Peat Marwick, and Price Waterhouse. 1992. *The Liability Crisis in the United States: Impact on the Accounting Profession*.
- Beatty, R. 1989. Auditor reputation and the pricing of initial public offerings. *The Accounting Review* 64 (October): 693-709.
- Benoit, E. 1991. The bean-counter blues. *Financial World* (January 22): 38-39.
- Bernard, V. 1987. Cross-sectional dependence and problems in inference in market-based accounting research. *Journal of Accounting Research* 25 (Spring): 1-48.
- Berton, L. 1990a. Laventhol and Horwath faces more woes as it loses unit and key executives. *The Wall Street Journal* (May 14): A3.
- . 1990b. Laventhol and Horwath beset by litigation runs into hard times. *The Wall Street Journal* (May 17): A1.

²²If the market views the resolution of monitoring uncertainties as being conditional upon the successor auditor being a highly credible firm, then SSLOSS and IPOLOSS should be replaced with interactive terms SSLOSS*CPATYPE and IPOLOSS*CPATYPE respectively. We ran such a regression, but these interactive terms were not significant.

- . 1992. Legal liability awards are frightening smaller CPA firms away from audits. *The Wall Street Journal* (March 3): B1, B5.
- Business Week*. 1990. Behind the fall of Laventhol. *Business Week* (December 24): 54-55.
- Chow, C., L. Kramer, and W. Wallace. 1988. The environment of auditing. In *Research Opportunities in Auditing: The Second Decade* (A. R. Abdel-khalik and I. Solomon, editors). Sarasota, FL: American Accounting Association: 155-183.
- Cohen, L. 1990. Laventhol breakup call hinted. *Chicago Tribune* (November 16): 1D, 2D.
- Cowan, A. 1990. Faltering Laventhol is reportedly closing. *The New York Times* (November 19): D1.
- DeAngelo, L. 1981. Auditor independence, 'low balling,' and disclosure regulation. *Journal of Accounting and Economics* 3 (August): 113-127.
- Drake, P., and M. Vetsuypens. 1993. IPO underpricing and insurance against legal liability. *Financial Management* 22 (Spring): 64-73.
- Eichenseher, J., M. Hagigi, and D. Shields. 1989. Market reaction to auditor changes by OTC companies. *Auditing: A Journal of Practice & Theory* 9 (Fall): 29-40.
- Fama, E., and K. French. 1992. The cross-section of expected stock returns. *Journal of Finance* 47 (June): 427-465.
- Kellogg, R. 1984. Accounting activities, security prices, and class actions suits. *Journal of Accounting and Economics* 6 (December): 185-204.
- Kennedy, P. 1985. *A Guide to Econometrics*. Cambridge, MA: M.I.T. Press.
- Kothari, S. P., T. Lys, C. W. Smith, and R. L. Watts. 1988. Auditor liability and information disclosure. *Journal of Accounting, Auditing & Finance* 3 (Fall) (New Series): 307-340.
- Kraakman, R. 1988. Discussion of auditor liability and information disclosure. *Journal of Accounting, Auditing & Finance* 3 (Fall) (New Series): 341-348.
- Maher, M. W., P. Tiessen, R. Colson, and A. J. Broman. 1992. Competition and audit fees. *The Accounting Review* 67 (January): 199-211.
- Newkirk, R. 1991. Sufficient efficiency: Fraud on the market in the initial public offering context. *University of Chicago Law Review* 58 (Fall): 1393-1422.
- Pae, P. 1990. Laventhol says it plans to file for Chapter 11. *The Wall Street Journal* (November 20): A3, A11.
- Palmrose, Z. 1991. Trials of legal disputes involving independent auditors: Some empirical evidence. *Journal of Accounting Research* 29 (Supplement): 149-185.
- Public Accounting Report*. 1990. Laventhol's last stand. (December 15): 3.
- Securities and Exchange Commission. 1991. *Staff Accounting Bulletin no. 90*.
- Schipper, K. 1991. Discussion of an analysis of auditor litigation disclosures. *Auditing: A Journal of Practice & Theory* 10 (Supplement): 72-76.
- Schwartz, K., and K. Menon. 1985. Auditor switches by failing firms. *The Accounting Review* 60 (April): 248-261.
- Simunic, D., and M. Stein. 1987. *Product Differentiation in Auditing: Auditor Choice in the Market for Unseasoned New Issues*. Vancouver, B.C.: The Canadian Certified General Accountants' Research Foundation.
- Tinic, S. 1988. Anatomy of initial public offerings of common stock. *Journal of Finance* 43 (September): 789-822.
- Wallace, W. 1987. The economic role of the audit in free and regulated markets: A review. *Research in Accounting Regulation* 1: 7-34.

Managerial Reputation and Internal Reporting

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SYNOPSIS AND INTRODUCTION: This paper demonstrates how a manager's concern for reputation can distort reports made to superiors about an investment project and hence, can affect a firm's capital budgeting decisions. In the first setting examined, a manager is assumed to know more than her superior about both her personal abilities and the prospects of a project under consideration. A manager's ability has two dimensions—ability to forecast a project's returns and productivity. A more talented manager has both better forecasting abilities and higher productivity than a less talented manager. It is shown that while a more talented manager always reports her assessment of a firm's project truthfully, a less talented manager's report depends on the magnitude of the difference in productivities between the more and less talented managers. When this productivity gap is large, the less talented manager conceals her lack of talent by claiming that the project's returns are low so as to discourage investment by the firm. *Shifting blame to factors beyond her control protects the manager's reputation.* Such managerial misreporting results in underinvestment by the firm. In contrast, where the productivity gap between a less talented manager and a more talented manager is small, a less talented manager guards her reputation by sometimes reporting favorable prospects and sometimes unfavorable prospects. This leads the firm either to over- or underinvest its resources, respectively. Thus, managerial misreporting occurs in equilibrium because a less talented manager tries to masquerade as a more talented manager, resulting in investment distortions.

Whether a manager's concern for reputation exacerbates or mitigates the incentive problem depends on the manager's type. While the labor market forces align the incentives of a more talented manager with those of the firm, they also serve to misalign incentives for a less talented manager.

In the second setting, this paper examines managerial investment distortion in the choice between short term and long term projects. Consider a scenario in which the

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outcome of a short term project is observed publicly earlier than that of a long term project. It is shown that managerial reputation incentives, coupled with superior two-dimensional private information, would cause a more talented manager to implement a short term or a long term project as dictated by the firm's interests, whereas a less talented manager with low productivity would choose a long term project. Through such choice, she is able to delay disseminating project outcome which is also informative about her type. A less talented manager who is relatively more productive would, however, implement a short term project sometimes and a long term project some other times.

These investment distortions cannot be avoided either by restructuring the decision-making responsibilities or by the principal's committing to any implementation rules.

Key Words: *Managerial reputation, Internal reporting, Participative budgeting, Managerial reporting incentives, and Investment distortions.*

SECTION I presents a typology of managerial reporting research as a review of the related literature. Section II describes the model, and section III analyzes the model and discusses the results. Finally, section IV summarizes the paper.

I. Literature Review

Studies on managerial reporting can be broadly classified into two categories. The first category of papers examines managerial reporting and communication as part of a contracting process or as determined by a given contract. These papers can be further classified into those that study reports designed to influence players external to the firm (e.g., Dye 1988) and others that analyze the manager's incentives in making reports internal to the firm (like Baiman and Evans 1983; Conroy and Hughes 1987). The second category of papers studies managerial reporting outside the context of a contracting setting. This stream of research generally concentrates on external reports and abstracts away from managerial reporting incentive issues; instead, the emphasis is on strategic reporting to maximize the firm value (for instance, see Verrecchia 1983).

This paper belongs to the second category in that the managerial reporting incentives are analyzed outside a contracting setting. However, in contrast to other research in this category, this paper studies the manager's reports that are internal to a firm in which the principal makes an investment decision based on such managerial reporting. Often, such internal reporting behavior of the manager is not directly influenced by her compensation incentives. Given the sheer volume of day-to-day intra-organizational communications, it is impossible in practice to design compensation contracts based on all internal managerial communication. In such incomplete contract settings, managers' reputation concerns may influence their reporting behavior. For instance, most major capital budgeting decisions are made at the very top levels in a firm, and the decision maker invariably relies on bottom-up communication in the process.¹ There exist other settings in which decisions are made based on internal communication of information, though such communication is not used as part of a contract in compensating the transmitter of such information. (For example, market information communicated by market researchers or field personnel, industrial engineers providing product or process design suggestions, and various other staff who advise decision makers within a firm.)

¹ As Magee (1986) notes, "a natural alternative (in the process of formulation of a capital budget) might be to ask the decentralized manager what her environment will be like over the next accounting period and then use her report ..."

Other papers that examine managerial reputation concerns are Kanodia et al. (1988) and Holmstrom and Ricart i Costa (1986). However, they study the manager's investment behavior, while this paper's focus is on the manager's reporting behavior. Further, the investment distortions can occur in either direction in this model as opposed to mostly unidirectional investment distortions in Kanodia et al. (overinvestment) and Holmstrom and Ricart i Costa (underinvestment). Finally, in this paper the manager's two-dimensional private information about both her ability and the investment environment enables a less talented manager to shield her reputation by citing factors beyond her control. In contrast, in Kanodia et al. and Holmstrom and Ricart i Costa, neither the manager nor the labor market is aware of the manager's type.

II. The Model

A principal employs a manager to work for her. Assume that both players are risk neutral and live for two periods. The manager may enter into only single period contracts. A description of first period events is provided below.

After the parties enter into a contract for the first period, there are two stages within that period. In the first stage (hereafter referred to as the reporting stage), the manager privately observes her type and the future prospects of a project under consideration (henceforth referred to as the state). The manager then makes a report to the principal about her private information. In the second stage (referred to as the implementation stage), the principal makes the investment decision and if she decides to invest, the manager implements the project.

The manager may be one of two types, more talented (z_T) or less talented (z_N). The state may be good (θ_G) or bad (θ_B). The manager's type and the state are independently distributed. The prior probability of a more talented manager is η and of a good state is ρ . At the beginning of the first period, the firm has a project under consideration which lasts for only one period.

A manager's talent has two dimensions in this model, foresight and productivity, both increasing with type. A more talented manager's greater foresight is operationalized by assuming that, at the reporting stage, she perfectly foresees the prospects of the project for the next stage; that is, she observes either θ_G or θ_B as the state for the implementation stage. A less talented manager, however, is unable to foresee the state for the next stage, i.e., she receives only a null signal (θ_0). In this model, capital budgeting proposals take the form of a report by the manager on the state. Thus, the manager's strategy is a mapping from her type and the state signal to her report to the principal. Her report may be $\hat{\theta}_G$, $\hat{\theta}_B$ or $\hat{\theta}_0$ representing the good state, the bad state and the null signal, respectively.²

This paper uses a non-contingent contracting framework, i.e., the manager's wage for a given period does not depend on either the firm's outcome or her report in that period.³ Let $R(z_k)$ refer to the expected marginal product of manager of type z_k , where $k=T, N$. Assume that the managerial labor market is perfectly competitive and consists of a large number of firms, all having identical

²Notice here that in principle the manager can be asked to report on both dimensions of her private information, i.e., both about her own type and the state signal. As discussed later in detail, with the manager not being able to commit to stay with the firm for both the periods, the revelation principle is not applicable in this model. Therefore, if the manager's report has to include her type too, all manager types will always claim that they are more talented in order to avoid earning lesser second period wages. Hence, for the sake of notational brevity, the manager's report about her type is suppressed, letting the analysis focus on her report about the observed state signal.

³Papers which examine managerial reputation effects typically adopt this noncontingent contracting framework for reasons of sharper focus, see for instance Kanodia et al. (1989) and Holmstrom and Ricart i Costa (1986). See Scharfstein and Stein (1990) for a detailed discussion of how admitting contingent contracts would only mitigate some inefficiencies arising out of managerial reputation effects but does not altogether eliminate them.

production technologies. Given that all firms share the same initial beliefs about a manager's type, they will expect an identical marginal product from a given manager.

In a competitive labor market, the manager's wage in a particular period reflects the market's current beliefs about the manager's type and hence, her expected marginal product. At the beginning of the first period the manager is offered a wage $W_1 = \eta R(z_T) + (1-\eta) R(z_N)$.⁴ The external labor market revises its priors about each manager's type at the end of the first period based on all the information available before offering a contract for the second period.

If the manager implements the project (IP), the project either succeeds, yielding y_S or fails, yielding y_F , where $y_S > 0 > y_F$.⁵ If the project is not implemented (NP), the firm receives a normalized risk free return of $y_0=0$. Therefore, the firm will implement the project if the expected cash flow from the project (conditioned on all the information available to it up to that point in time) is positive. With a more talented manager working in a good state, the project is assumed to succeed with probability one. With a less talented manager working in a good state, the project succeeds with some probability ϕ , where $0 < \phi < 1$. However, with a bad state the project always fails irrespective of the type of the manager.

Let $\mu_1(\theta, z/\hat{\theta})$ refer to the principal's posterior belief about the manager's type and the state, given that she receives the report $\hat{\theta} \in \{\hat{\theta}_G, \hat{\theta}_B, \hat{\theta}_0\}$. Based on this revision, the principal decides on her project implementation strategy. Thus, the principal's strategy consists of a mapping from the manager's report to a project implementation decision. The principal's first period objective function is to maximize the sum of her expected payoffs from the first and second period projects, net of the manager's expected second period wages, given the manager's report.⁶ That is, the principal maximizes the function $E\Pi^1(\cdot) + E\Pi^2(\cdot) - E[W_2]$, where $E\Pi^1(\cdot)$ refers to the expected payoff to the principal from implementing the project in period t , $t=1,2$ and $E[W_2]$ denotes the manager's expected second period wages.

The manager's report to the principal is assumed to be internal information for the firm. The labor market is assumed to be able to observe whether the project was implemented and, if implemented, the project outcome. Hence, the labor market derives its posterior beliefs about the manager's type, $\mu_2(z/y)$ based only on the project outcome.

It is assumed that all the firms repeat their first period production processes in the second period. That is, the game as described above for the first period is repeated during the second period, with the only difference being that the second period wages offered to any manager by any firm will be shaped by the market's posterior beliefs about that manager's type, $\mu_2(z/y)$. Further, the distribution of the state in each period is assumed to be independent of the other.

The time line for this model is as follows:

⁴It is assumed that the principal has enough endowments to pay the manager her wages in any period independent of her decision to implement the project.

⁵If y_S is negative, then the principal has no incentive to implement the project in any state. Similarly, if y_F is positive, then the principal can always implement the project, ignoring the manager's report, with the result that the manager's report plays no role.

⁶Because the first period wage of the manager is a sunk cost to the principal at the time of project implementation decision (since it is already committed to and has to be paid independent of the principal's decision), it vanishes from the principal's first period objective function.

First Period

First Stage (Reporting Stage)		Second Stage (Implementation Stage)	
Principal and manager contract.	Manager privately observes her type and the state signal; reports to the principal.	Principal revises her beliefs about the manager's type & the state; makes the investment decision.	Project outcome is publicly realized; manager is paid her first period wages; the labor market and the principal revise their beliefs.

Second Period

Manager receives the second period wage offers from the market and the incumbent firm based on their beliefs about her. All the players repeat their first period game.

This paper abstracts away from moral hazard issues. Instead, the manager's concern for reputation is the source of the incentive problem here. All players, including the external labor market, have common priors about nature's moves and the entire structure of the game is assumed to be common knowledge. See Appendix 1 for a summary of notation.

III. Analysis and Results

This section first describes the principal's first-best decision rule. Next, the reporting equilibria in a second-best setting are characterized. Misreporting in equilibrium is shown to result in a reduction of the principal's welfare. Finally, this section identifies the managerial project selection equilibria when the manager is asked to implement one of two different projects, a short term project and a long term project.

Using backward recursion, the analysis of the manager's reporting behavior begins with the second period. In light of the non-contingent contracting framework and the fact that the second period constitutes the last period in the manager's career, the manager's second period reporting strategy will not affect future welfare. Hence, the principal can expect the manager to follow the socially preferred rule, which is to report truthfully and cause no investment distortions in the second period. Using this result, the next section proceeds with further analysis of the model.

First-Best Setting

A first-best setting is characterized by symmetry of information between the manager and the principal, i.e., the principal also observes the manager's type and the state signal. Thus, when a less talented manager receives a null state signal the principal also observes a null signal. Let $\Pi(z_N, \theta_o)$ refer to the expected profits the principal would earn in a first-best world from implementing the project with a less talented manager when neither the principal nor the manager knows the state. Then, $\Pi(z_N, \theta_o) = \rho(\phi y_s + (1-\phi)y_F) + (1-\rho)y_F = y_F + \rho\phi \delta y$, where $\delta y = y_s - y_F$. Proposition 1 characterizes the principal's first-best implementation strategy as a benchmark.

- Proposition 1: i) If $\Pi(z_N, \theta_o) > 0$, the principal's first-best decision rule will always be to implement the project unless she observes a bad state.
 ii) If $\Pi(z_N, \theta_o) < 0$, the principal's first-best decision rule will be to implement the project only when she has a more talented manager and the good state.

With a less talented manager, if $\Pi(z_N, \theta_0) = 0$ the principal is indifferent between implementing the project or not.

Second-Best Setting

In a second-best setting, the principal observes the report issued by the manager, but not the manager's type or the state signal. With noncontingent contracting and the manager's ability to commit only to a single period contract in a multiperiod world, the Revelation Principle (Myerson 1979) is not applicable in this model. Because only a less talented manager ever observes the null signal, reporting this signal would reveal her true type, resulting in a reduction in her second period market wages. Therefore, the less talented manager will prefer to pool with the more talented manager. On the other hand, the more talented manager's second period wages will be higher on separation. Thus, while pooling is in the interest of the less talented manager, separation is beneficial to the more talented manager.

Because the sequential equilibrium conditions themselves impose no restrictions on the reasonableness of out-of-equilibrium beliefs, several unintuitive equilibria supported by implausible beliefs may satisfy the criteria of a sequential equilibrium. For instance, any total pooling equilibrium in this game satisfies the concept of a sequential equilibrium. Specifically, consider an equilibrium in which both types of managers always report a null state signal. As the manager's report is totally uninformative about the state in this equilibrium, the principal decides on her implementation strategy based on her prior beliefs. This is clearly a sequential equilibrium, supported by out-of-equilibrium beliefs that the probability that the manager is talented after observing either a good state or a bad state report is zero. However, such out-of-equilibrium beliefs do not seem to be reasonable. Such an equilibrium seems implausible because the talented manager who observes a good state signal can gain reputational rents by reporting the good state and separating herself out.

One way of eliminating such unintuitive sequential equilibria is to use the refinement of a Perfect Sequential Equilibrium (PSE).⁷ See Appendix 2 for a complete technical specification of the equilibrium.⁸ In a PSE, neither manager type wishes to deviate from her equilibrium strategy given that the principal would alter her beliefs correspondingly contingent on such a deviation by the manager.

⁷ As Myerson (1986) has observed, in any standard costless signaling game there always exists a "babbling equilibrium" in which the sender of the message randomizes over the set of her reports independently of her information and the receiver of the message ignores the sender's meaningless reports and decides on her strategy based on her priors. In general, the babbling equilibrium satisfies the criteria of a PSE. The only way to rule out such a babbling equilibrium is by invoking Farrell's (1986) criterion of a neologism-proof equilibrium.

However, in this seemingly costless signaling model such a babbling equilibrium only satisfies the criteria of a sequential equilibrium but not those of a PSE. The reason why such an uninformative reporting (babbling) equilibrium in this model satisfies only the criteria of a sequential equilibrium but fails to meet the criteria of a Perfect Sequential Equilibrium may be ascribed to the implicit cost of the signal sent by the manager to the principal. Although the manager's report is seemingly costless in this game, the more talented manager always stands to gain by separating herself out. Therefore, she loses these reputational gains whenever she pools totally with the less talented manager. Also, if the less talented manager wants to have the project implemented by reporting a good state, she has a potential cost to incur in terms of the possibility of her type being revealed when she does not succeed with the project. Hence, the manager's signal does indeed generate some implicit cost in this game. Recognition of the implicitly costly signals resolves the apparent anomaly between Myerson's remarks and the babbling equilibria in this game. The use of the PSE refinement, as a solution concept helps in eliminating these implausible "babbling equilibria" in the setting considered here.

⁸ PSE is a refinement suggested by Grossman and Perry (1986) to the sequential equilibrium concept introduced by Kreps and Wilson (1982). The PSE is one of the more generally accepted equilibrium refinement concepts in the literature. The PSE concept is stronger than the Intuitive Criterion of Cho and Kreps (1987) in the sense that the former implies the latter but not vice versa. However, a PSE does not necessarily exist for all games.

Reporting Equilibria

Given this economic environment, two mutually exclusive reporting equilibria are characterized in Propositions 2 and 3. The equilibrium reporting strategies of the manager depend on the productivity parameter of the less talented manager, ϕ .⁹ Proposition 2 (Proposition 3) below characterizes the reporting equilibrium when the less talented manager is less (more) productive

relative to an endogenously derived threshold level, γ where $\gamma \equiv \left(\frac{\eta(1-\rho)}{\rho(1-\eta\rho)} \right)$. Let the principal's expected payoff from implementing the project when she receives a bad state report in the first reporting equilibrium identified by Proposition 2 be denoted by $E\Pi(IP/\hat{\theta}_B)$, where

$$E\Pi(IP/\hat{\theta}_B) \equiv y_F + \left(\frac{(1-\eta)}{(1-\eta\rho)} \right) (\rho\phi) \delta y.$$

Proposition 2: Assume that the economic environment is such that:

a) the less talented manager's productivity is less than the threshold level ($\phi < \gamma$), (C1)

and

b) the project returns are not so great as to warrant implementing the project always ($E\Pi(IP/\hat{\theta}_B) < 0$). (C2)

Then there exists a unique PSE in which

i) the more talented manager always reports the observed state truthfully;

ii) the less talented manager always reports the bad state; and

iii) the principal implements the project if and only if she receives a good state report.

Proofs for this and subsequent propositions and corollaries are given in Appendix 3.

If a more talented manager observes θ_G and reports $\hat{\theta}_G$, the principal decides to implement the project in the second stage. By being successful with the project, the more talented manager is separated and can expect the highest second period wage (equal to $R(z_T)$) from the market, which revises its beliefs about the manager's type based on the publicly observed project outcome. On the other hand, if she were to report $\hat{\theta}_B$ after observing θ_G she would lose this opportunity of establishing herself as a more talented manager. Similarly, if the more talented manager observed θ_B and reported $\hat{\theta}_G$, the project would be implemented, resulting in a loss and the market would revise her second period wages downward.

If a less talented manager reported $\hat{\theta}_G$ after observing the null signal, the project would be implemented and, with probability $\rho\phi$, she might succeed in the project and thereby command a higher second period wage on being perceived by the market as being a more talented manager with higher probability. However, with probability $(1-\rho\phi)$ she would fail in the project and would

⁹In games such as this one where the sender incurs no explicit cost of transmitting a message, there always exist other equilibria where "pseudo-language" may be adopted (see Farrell 1986). For instance, corresponding to the equilibrium discussed in Proposition 2, we could have another equilibrium in which all the players interpret the messages in this fashion: whenever the manager uses the term "good state" she means "bad state" and vice versa. Then, in the place of the equilibrium in Proposition 2 we have another equilibrium in which the more talented manager reports a bad state whenever she observes a good state and reports a good state whenever she observes a bad state with the less talented manager always reporting a good state. The optimal implementation strategy for the principal in such a pseudo-language game would be to implement the project if and only if she gets a bad state report from the manager. Such an equilibrium involving this pseudo-language also satisfies the criteria of a PSE. We eliminate such equilibria by resorting to the convention that all the players in the game restrict themselves to the common meaning of the terms used.

be correctly identified as a less talented manager by the market and would earn less in the second period. Hence, a better alternative for the less talented manager with a low productivity (i.e., $\phi < \gamma$) is to report $\hat{\theta}_B$, thereby inducing the principal not to implement the project.

Because it is only the less talented manager who observes the null state signal, reporting a null signal would lead a manager to be classified as less talented, resulting in a loss of reputation for the manager. Therefore, the less talented manager guards her reputation by "shifting the blame to state factors" beyond her control and reports a bad state. Thus, managerial misreporting occurs in equilibrium. A more talented manager can separate herself out when a good state occurs, whereas she cannot avoid pooling when the state is bad.

Condition (C1) is more likely to be met when the productivity gap between the more talented and the less talented manager is large or when the prior probability of the manager being more talented or the state being bad is relatively high. For instance, if $p(\theta_G) = 0.5$ and $p(z_T) = 0.5$, then $\gamma = \frac{2}{3}$ and the probability of the less talented manager succeeding with the project in a good state (ϕ) must be less than $\frac{2}{3}$ for condition (C1) to be met.

Condition (C2) provides sufficient conditions for value to managerial participation in budget formulation. Condition (C2) implies that the principal's expected payoff from the project is negative when she implements the project on receiving a bad state report in equilibrium. This ensures that the principal's implementation strategy is a function of the manager's report. For instance, if the failure of the project implies a fairly substantial loss to the firm, condition (C2) would be more likely to be met. On the other hand, when the success of the project implies very high profits with failure involving little loss, the principal will find it in her interest always to implement the project, implying that the manager's report plays no role.

Proposition 3 characterizes the reporting equilibrium when condition (C1) is not met. This case applies when the productivity of the less talented manager is relatively high. In this setting, no pure strategy equilibrium exists for the manager; only a mixed strategy reporting equilibrium is obtained. In this equilibrium, a more talented manager reports truthfully while a less talented manager randomizes over the good and bad state reports, with probabilities q and $1-q$, respectively, where

$$q \equiv \left\{ \frac{\sqrt{\phi\rho}(1-\rho\eta) - \eta(1-\rho)}{\sqrt{\phi\rho}(1-\eta) + (1-\rho)(1-\eta)\phi} \right\}.$$

Let the principal's expected payoffs from implementing the project when she receives a bad state and a good state report in this second equilibrium be denoted respectively by

$$\begin{aligned} E\P_2(IP/\hat{\theta}_B) &\equiv y_F + \left\{ \frac{(1-\eta)(1-q)}{\eta(1-\rho) + (1-\eta)(1-q)} \right\} (\rho\phi)\delta y \text{ and} \\ E\P_2(IP/\hat{\theta}_G) &\equiv y_F + \left\{ \frac{\rho\{\eta + (1-\eta)q\phi\}}{\eta\rho + (1-\eta)q} \right\} \delta y. \end{aligned}$$

Proposition 3: Assume that the economic environment is such that:

a) the less talented manager's productivity is greater than or equal to the threshold level ($\phi \geq \gamma$); and (C3)

b) the project returns are neither so attractive as to warrant always implementing the project ($E\Pi_2(IP/\hat{\theta}_B) < 0$); (C4)

c) nor so unattractive as to warrant never implementing the project ($E\Pi_2(IP/\hat{\theta}_G) \geq 0$). (C5)

Then there exists a unique PSE in which

i) the more talented manager always reports the observed state truthfully;

ii) the less talented manager reports the good state with probability q and the bad state with probability $1-q$; and

iii) the principal implements the project if and only if she receives a good state report.

In this equilibrium, conditions (C4) and (C5) constitute sufficient conditions for value to managerial participation. If conditions (C4) and (C5) are not met, then the principal's implementation decision is independent of the manager's report, leaving no role for the manager's reports.¹⁰

Corollary 3.1 describes how the parameters of the model affect the manager's reporting behavior and the determination of a given reporting equilibrium out of two mutually exclusive ones.

Corollary 3.1: i) The probability of the less talented manager reporting a good state in the second reporting equilibrium (q) increases in her likelihood of succeeding with the project in a good state (ϕ) and the prior probability of the state being good (ρ) and decreases in the prior probability of the manager being talented (η).

ii) The threshold level (γ), determining the realization of a given reporting equilibrium out of the two possible equilibria, increases in the prior probability of the manager being talented (η) and decreases in the prior probability of the state being good (ρ).

As the probability of a less talented manager's success in the good state (ϕ) increases, she finds it increasingly beneficial to encourage the principal to implement the project as her chances of getting a higher second period wage are enhanced. Similarly, as the prior probability of the good state increases, her chances of success with the project increases. Hence, she again finds it in her interest to report the good state with greater frequency. As the prior probability of the manager being more talented (η) increases, the principal attaches increasing weight to the manager being more talented even when she observes a bad state report. Hence, a less talented manager bears a greater opportunity cost in reporting a good state when η value is high: should the project fail, she will be identified as less talented. So, she would prefer to report a bad state with a higher probability.

As the prior probability of the manager being talented (η) increases, the posterior weight attached to a bad state report coming from a more talented manager also increases and the less talented manager has less incentive to report the good state; hence, the threshold level γ shifts to the right. In contrast, if the prior probability of a good state (ρ) increases, the less talented manager

¹⁰Note that when $\gamma = \phi$, $q = 0$, i.e., a less talented manager always reports the bad state.

finds it increasingly beneficial to report a good state and succeed with the project. This means that γ decreases. Hence, the results in the second part of Corollary 3.1.

There is one major difference in terms of separation of the two managerial types between these two reporting equilibria. In the first equilibrium, the less talented manager never gets separated out. It is only the more talented manager who gets separated out when she reports a good state and is successful with the project. The prior probability of this happening is $\eta\rho$. In the second equilibrium, the more talented manager never gets separated out. It is the less talented manager who gets separated out ex post, when she reports a good state and fails in the project, revealing the cause of past overinvestment to be her lack of foresight.¹¹ The ex ante probability of this happening is $[(1-\eta)q(1-\rho\phi)]$.

The mimicking behavior of the various manager types in this reputation game differs from results obtained in moral hazard problems. In such models (for instance, Sappington (1983)), it is the more productive manager who mimics the less productive manager. In such cases, the less productive managers incur more disutility to produce a given outcome and hence, have to be compensated more for their greater disutility in exerting a higher effort level in achieving a given outcome level. Thus, in models involving moral hazard, the more productive managers get informational rents from their private knowledge of their productivity levels from mimicking the less productive managers. In contrast, in this reputation model, it is the less talented manager who mimics the more talented manager's reporting behavior in an attempt to enhance her reputational gains.

A manager is said to enjoy rents from her private information if she gets a higher wage in the second-best setting than in the first-best setting. Note that in this game the more talented manager commands no rent from her private information. It is only the less talented manager who gains information rent and such gains to the less talented manager come at the expense of the more talented manager. For instance, in the second equilibrium, the second period wage of the less talented manager is more than her second period expected marginal product, whereas the more talented manager's second period wage is less than her expected second period marginal product. Thus, in this game, the more talented managers subsidize the less talented managers in the external marketplace. This information rent that the less talented manager enjoys is referred to as reputation gains. Corollary 3.2 next derives the relationship of these reputation gains to various parameters.

Corollary 3.2: The less talented manager's reputation gains are increasing in δR an η and decreasing in ρ and ϕ .

As the productivity gap increases, the reputation gains to a less talented manager increase because she has more to gain by mimicking the more talented manager. As the prior probability of the manager being more talented increases, on the receipt of a bad state report the principal attaches greater probability to the manager being more talented. Therefore, the less talented manager loses more by admitting that she observed a null signal, and her information rent increases in η . In the second equilibrium, as ρ or ϕ increases, the probability of the less talented manager succeeding with an implemented project increases. Therefore, the principal assesses a

¹¹ For instance, several medium sized oil companies which continued to invest in oil-related assets after the oil boom had subsided in the early 1980s were reluctant to write down their assets promptly to reflect their reduced worth. Their managers waited so long to take a big bath (in most cases until 1985-86) "because it does not make them look like very good stewards of shareholders' interests" (*Forbes*, February 24, 1986, p. 78).

lower posterior probability that the manager is more talented even if the project succeeds, and the less talented manager's information rent decreases in ρ and ϕ .

Investment Distortions

The manager's reputation concerns cause a divergence between her personal interests (in returns from her human capital) and the firm's financial interests, leading to investment distortions. Proposition 4 below states that such distortions can appear as either capital rationing or overinvestment by the firm. Recollect from the analysis of the first-best setting that $\Pi(z_N, \theta_o) = y_F + \rho\phi\delta y$ refers to the principal's expected payoffs from implementing the project with a less talented manager when neither player observes the realized state, θ .

Proposition 4: (i) Suppose $\Pi(z_N, \theta_o) > 0$. If the parameters are such that the conditions (C1) and (C2) in Proposition 2 are met, then underinvestment (capital rationing) occurs.

Alternatively, if conditions (C3), (C4) and (C5) in Proposition 3 are met, then again the principal underinvests when the less talented manager reports the bad state with probability $1-q$.

(ii) Suppose $\Pi(z_N, \theta_o) < 0$. If conditions (C3), (C4) and (C5) in Proposition 3 are met, then the principal overinvests when the less talented manager reports the good state with probability q .

Corollary 4.1: The expected value of investment distortion decreases in the probability of the manager being more talented (η) and, when conditions (C1) and (C2) are met, increases in the probability of the good state (p).

Proposition 4 implies that the principal's expected profits in the first-best setting are greater than in the second-best. In case (i), the welfare loss is the result of foregoing $\Pi(z_N, \theta_o)$, i.e., the expected profits the principal could have earned by investing when the manager was less talented and received only a null signal. In case (ii), when $\Pi(z_N, \theta_o) < 0$, the firm would not have invested in the project in the first-best setting. However, on receipt of a good state report from a less talented manager in the second-best setting, the principal overinvests.

A less talented manager "substitutes" the state for her type in reporting to the principal, in order to pool with a more talented manager. This behavior distorts the principal's investment decisions and, either underinvestment (capital rationing) or overinvestment could arise as a result of two-dimensional information asymmetry.¹²

In this model, even if the principal were allowed to commit herself to any project implementation rule, she could not do better. It is straightforward to show that the principal's optimal commitment rule involves implementing the project only on observing a good state report and the managers would report precisely in the same fashion as outlined in Propositions 2 and 3.

¹² Sales budget formulation and analysis of sales variances are other areas in which a similar phenomenon is frequently encountered. A general sales manager in charge of formulating a sales budget often relies on the estimates of regional sales managers (or other field staff) in arriving at a target. In the process, the field staff often refer to unfavorable environmental factors (bad states), which are beyond their control as reasons for proposing unambitious targets. Again, in the case of analysis of sales variances, when unfavorable variances occur the general sales manager often gets explanations in terms of bad state and she is called upon to exercise her judgment in distinguishing the real reasons (such as poor performance by sales personnel) from excuses.

Therefore, the expected payoffs from the principal's optimal commitment rule would equal her expected payoffs without commitment when the implementation rule is chosen to be sequentially rational.

Further, the investment distortion result obtained in this model is not an artifact of the organizational design. That is, it can be shown that even if the principal delegates the investment decisionmaking responsibility to the manager, she cannot avoid the investment distortions arising out of information asymmetry. When the manager is delegated both investment decisionmaking and implementation tasks, equilibria similar to those stated in Propositions 2 and 3 above are obtained. Both the more talented and the less talented manager report as they do in the above equilibria. In addition, both types of managers implement the project whenever they report a good state and do not implement the project whenever they report a bad state.

Short Term versus Long Term Project Selection

This section examines the managerial reputation-induced incentive problem of selecting one out of multiple projects, viz., a short term and a long term project. Narayanan (1985) shows that a manager who does not know her type would always choose the short term project in an attempt to establish a reputation for being more talented as early in her career as possible. In contrast, it is shown here that with managerial private information about her type, a manager's reputation concern might drive the choice of either type of project in equilibrium. This opposing result is obtained here because the less talented manager wants to delay the project outcome from being disseminated to the market to guard her reputation and one way of doing so is to implement a long term project.

Consider the setting described in section II with the following changes. Assume that the manager is delegated the choice between two projects, a short term project (S) and a long term project (L), only one of which can be implemented. A short term project lasts for only one period, and its outcome becomes public at the end of the first period. A long term project, in contrast, is assumed to last for two periods and yields a publicly observable outcome only at the end of the second period.¹³ When a long term project is implemented, the labor market observes no project outcome at the end of the first period. The manager's choice of project is assumed to be publicly observable.

Redefine the state space to be $\{\theta_s, \theta_L\}$. Assume that if $\theta = \theta_s$ ($\theta = \theta_L$) in a first-best world, the principal would maximize her welfare by implementing a short term (long term) project. Further assume that if the project type is not properly aligned with the state, the project fails regardless of manager type. If the project is properly aligned with the state, the probability of success is one for the more talented manager and ϕ for the less talented manager ($1 > \phi > 0$). Finally, assume that the priors about the state, the manager type and the returns from project types are such that it is not in the principal's interests to force the manager always to implement only one type of project.¹⁴ The rest of the model follows the description provided in section II above.

Proposition 5 demonstrates that, in equilibrium, managerial reputation concerns will align the incentives of the more talented manager with those of the firm, but the incentives of the less talented manager will conflict with those of the firm.

¹³ This typically is the case when the scope of the project is so large that the firm has to undertake such time consuming activities as market research, concept design, prototype development and pilot production before resorting to actual production and sales. In such instances, often it is hard to gauge the eventual long term outcome in the short run.

¹⁴ This assumption is essential to make the following analysis a nontrivial one. Conditions similar to (C2) when $\gamma > \phi$ and conditions similar to (C4) and (C5) when $\phi \geq \gamma$, would ensure that this assumption holds.

Proposition 5: Assume that the principal can observe neither the manager's talent nor the project state.

- a) If the less talented manager's productivity is less than the threshold level ($\phi < \gamma$), then there exists a unique PSE in which
 - i) the more talented manager implements that project which the principal would have chosen in a first-best setting; and
 - ii) the less talented manager always implements the long term project.
- b) On the other hand, if the less talented manager's productivity is greater than or equal to the threshold level ($\phi \geq \gamma$), then there exists a unique PSE in which
 - i) the more talented manager again implements that project which the principal would have chosen in a first-best setting; and
 - ii) the less talented manager implements the short term project with probability q (as defined in section III) and the long term project with probability $1-q$.

The main intuition behind Proposition 5 is similar to that behind Propositions 2 and 3. In this model, the manager is able to commit only to a single period contract and the external labor market revises its beliefs based on the publicly observed project outcome. The less talented manager does not observe the underlying state whereas the more talented manager does. Combined with her lesser productivity, this encourages the less talented manager to delay the project outcome from being disseminated to the market to guard her reputation. One way of doing so is to implement a long term project, whose outcome is not immediately known. The less talented manager can "jam" the labor market's inference of her type because, in equilibrium, the more talented manager also implements a long term project whenever the underlying state favors such a project type.

In the two mutually exclusive equilibria outlined in Proposition 5, the less talented manager's project selection may not maximize the firm's welfare. For instance, such distortion would occur when the parameter values are such that the principal would have preferred to implement a short term project with a less talented manager, but the manager implemented a long term project to delay the public release of project outcome.

In the setting considered in this subsection, the principal could alternatively ask the manager to report her private information about the state (as in the earlier sections), and centralize the project implementation decision. While the more talented manager would report her private information about the state truthfully, the less talented manager would always report θ_L if $\gamma > \phi$ and report θ_S and θ_L with probabilities q and $1-q$ respectively if $\phi \geq \gamma$, thus misleading the principal in her choice of the project. Thus, centralization of the project implementation decision would not eliminate the less talented manager's misreporting incentives or the resultant investment distortions.

IV. Summary and Extensions

This paper demonstrates how a manager's reporting incentives, shaped by reputation concerns, can affect her budget participation and lead to investment distortions. Two different reporting equilibria are characterized depending on the relative value of the productivity of the less talented manager. A more talented manager always reports truthfully. When the productivity of a less talented manager is below a threshold level, this manager always forecasts an unfavorable investment climate. This managerial misreporting results in capital rationing by the firm since the principal cannot distinguish between an honest bad state report issued by a more talented manager

and a cover-up bad state report issued by a less talented manager. In the second equilibrium, when the productivity of the less talented manager is above the threshold level, she chooses randomly between the bad and the good state reports. This, in turn, produces either capital rationing or overinvestment, depending on the values of certain parameters. Thus in this model, a manager's reputation concerns will affect her reporting and investment behavior depending on her type: a more talented manager will make the same decisions that the principal would have made in a first-best setting, while the same reputation effects encourage a less talented manager to cause investment distortions.

This paper further examines managerial incentives in the choice of a short term versus long term project. In contrast to the earlier literature, it is found that managerial private information could cause either project to be implemented in equilibrium. When the productivity of a less talented manager is less than a threshold level, this manager always chooses the long term project so as to delay the dissemination of project outcome in an attempt to guard her reputation. When her productivity is sufficiently high, the less talented manager chooses randomly between the short and long term projects.

One possible extension involves examining the interaction between reporting strategies of multiple managers when their states are correlated. Such interactive reporting behavior of multiple managers might reduce investment distortions if the principal could use one manager's report to police the other's. Another extension might examine the managerial reporting behavior over several periods. A less talented manager with low productivity would lose her credibility by reporting that she observed a bad state for many periods in succession. Hence, in equilibrium, the less talented manager would randomize over the state reports while the more talented manager would always report the observed state truthfully.

Appendix 1 Summary of Notation

- z_T : more talented manager, and z_N : less talented manager.
 $\{y_S, y_F, y_0\}$: outcomes realized on the project being a success (y_S), failure (y_F) or not undertaken at all (y_0), respectively, with $y_S > 0$, $y_F < 0$ and $y_0 = 0$.
 $\{\theta_G, \theta_B, \theta_0\}$: the state signal observed by the manager, good, bad or null, respectively.
 $\hat{\theta}_i$: Manager's report i , for $i=G, B$ and 0 .
 $\eta = p(z = z_T)$, prior probability that the manager is talented, where $1 > \eta > 0$.
 $\rho = p(\theta = \theta_G)$, prior probability of the second stage state being good, where $1 > \rho > 0$.
 $\phi = p(y_S/z_N, \theta_G)$, where $0 < \phi < 1$.
 $R(z_j)$: the expected marginal product of manager type j , $j=T, N$
 $\delta R = R(z_T) - R(z_N)$
 W_t : Manager's wage in period t , $t=1, 2$.
 $\delta y = y_S - y_F$
 $\mu_1(\theta, z/\hat{\theta})$: principal's posterior beliefs about the state and the manager's type on obtaining the manager's report, $\hat{\theta}$.
 $\mu_2(z/y)$: market's posterior beliefs about the manager's type at the end of the second stage on observing project outcome, y
 π, τ : manager's reporting and the principal's implementation strategies respectively.
 $\{IP, NP\}$, represents the principal's response set, where IP stands for implementing the project and NP for not implementing the project.

$E\Pi^t(IP/\hat{\theta})$: Expected payoffs to the principal from implementing the project in period t , on receipt of report, $\hat{\theta}$ from the manager, for $t=1,2$.

Appendix 2

Definition of an Equilibrium

A *Perfect Sequential Equilibrium* is an assessment $((\mu_1(.), \mu_2(.)), (\pi, \tau))$ such that:

(i) $\pi(\hat{\theta}/\theta, z) \geq 0$,

$$\sum_{\hat{\theta}} \pi(\hat{\theta}/\theta, z) = 1.$$

$\pi(\hat{\theta}/\theta, z) > 0$ if and only if $\hat{\theta}$ maximizes $E[W_2]$.¹⁵

(ii) $\tau(IP/\hat{\theta}) \geq 0$,

$$\tau(IP/\hat{\theta}) + \tau(NP/\hat{\theta}) = 1.$$

$\tau(IP/\hat{\theta}) > 0$, if and only if IP maximizes $E\Pi^1(IP/\hat{\theta}) + E\Pi^2(.) - E[W_2]$.

(iii) There exist a sequence of manager's decision strategies $\pi_n(\hat{\theta}/\theta, z)$, a sequence of principal's decision strategies $\tau_n(IP/\hat{\theta})$ and sequences of beliefs $\mu_{1n}(\theta, z/\hat{\theta})$ and $\mu_{2n}(z/y)$ such that :

a) $1 > \pi_n(\hat{\theta}/\theta, z) > 0$, $\forall \hat{\theta} \in \{\hat{\theta}_G, \hat{\theta}_B, \hat{\theta}_O\}$, $\forall \theta \in \{\hat{\theta}_G, \hat{\theta}_B, \hat{\theta}_O\}$ for $z = z_N, z_T$ and $\forall n$;

$$1 > \tau_n(IP/\hat{\theta}) > 0, \quad \forall \hat{\theta} \in \hat{\Theta};$$

b) $\mu_{1n}(\theta, z/\hat{\theta})$ and $\mu_{2n}(z/y)$ satisfy Bayes' rule, whenever possible;

$$\lim_{n \rightarrow \infty} \mu_{1n}(\theta, z/\hat{\theta}) = \mu_1(\theta, z/\hat{\theta});$$

$$\lim_{n \rightarrow \infty} \mu_{2n}(z/y) = \mu_2(z/y);$$

$$\lim_{n \rightarrow \infty} \pi_n(\hat{\theta}/\theta, z) = \pi(\hat{\theta}/\theta, z); \text{ and}$$

$$\lim_{n \rightarrow \infty} \tau_n(IP/\hat{\theta}) = \tau(IP/\hat{\theta}).$$

(iv) Let $EW_2^*(z)$ refer to the equilibrium expected second period wages for manager type, z and Z refer to the set of manager's types. For any message $\hat{\theta}'$ that is never sent in equilibrium, there exists no subset K of manager types such that $EW_2^*(z) \leq EW_2(z, \hat{\theta}', a^*)$, if and only if $z \in Z \setminus K$, where a^* refers to the principal's best response when she believes that $p(z \in K) = 0$.

Conditions (i)-(iii) above define a sequential equilibrium for this game. Condition (iv) is adapted from Grossman and Perry (1986) to ensure that the updating rule is "credible." Condition (i) above implies that the manager chooses, from a set of completely mixed strategies, that strategy which maximizes her expected second period wage. Condition (ii) above imposes a similar condition on the principal. The first part of the third condition represents the fact that the sequences of the players' strategies must be drawn from sets of completely mixed strategies and the second part imposes the consistency criterion of Kreps and Wilson. Condition (iv) implies that there exist no manager types who would like to deviate in equilibrium, where if deviation is taken as a signal that $z \in Z \setminus K$, then $z \in Z \setminus K$ wants to deviate and $z \in K$ does not.

¹⁵ The first period wage is not included in the manager's objective function because it is already committed to and is independent of her report.

Appendix 3 Proofs for Propositions

Proof for Proposition 2:

In this proposition, the less talented manager's productivity is less than a certain threshold level, $\phi < \gamma$ (i.e., condition (C1) is met). The conjectured strategies along with supporting belief structure are shown to constitute the unique PSE in four steps. Step 1 derives the principal's beliefs at the first stage ($\mu_1(\theta, z/\hat{\theta})$) about the state and the manager's type on obtaining the manager's report and the market's beliefs at the second stage ($\mu_2(z/y)$) about the manager's type on observing the project outcome. The manager's second period market wages are determined by these market beliefs. In step 2, the optimality of the manager's reporting strategy is analyzed, given the principal's implementation strategy. In step 3, the sequential rationality of the principal's project implementation strategy is established. Finally in step 4, the perfection requirements of a PSE are shown to be met and the uniqueness of the PSE is demonstrated.

Step 1:

Consider the candidate equilibrium outlined in Proposition 2. On obtaining the manager's report (stage 1) the principal forms posterior beliefs about both the underlying state and the manager's type through Bayesian updating. She uses these beliefs in formulating the project implementation strategy. The principal's equilibrium beliefs at the first stage:

$\mu_1(\theta = \theta_G, z = z_T / \hat{\theta}_G) = 1$; $\mu_1(\theta = \theta_B, z = z_T / \hat{\theta}_B) = \left(\frac{\eta(1-\rho)}{(1-\eta\rho)} \right)$; and the off-equilibrium path belief, $\mu_1(\cdot, z = z_T / \hat{\theta}_o) = 0$.

More specifically, $\mu_1(\theta = \theta_G, z = z_N / \hat{\theta}_o) = \rho$ and $\mu_1(\theta = \theta_B, z = z_N / \hat{\theta}_o) = 1 - \rho$. The off-equilibrium posterior belief about the state are the same as the priors when the principal obtains a null state report, while the off-equilibrium posterior belief about the manager being talented is zero. (It is straightforward to check that only these off-equilibrium beliefs survive the PSE refinement criteria.)

After observing the project outcome, the market forms posterior beliefs as follows:

$\mu_2(z_T / y_S) = 1$; $\mu_2(z_T / y_o) = \left(\frac{\eta(1-\rho)}{(1-\eta\rho)} \right)$; and the off-equilibrium belief, $\mu_2(z_T / y_F) = 0$. It is

straightforward to show that the above beliefs satisfy the requirements of consistency, given the equilibrium strategies of the manager and the principal.

Let $w_2(y_m)$ represent the second period wage that the external labor market offers the manager after the firm realizes first period project outcome y_m . These second period wages as determined

by the above posterior beliefs are: $w_2(y_S) = R(z_T)$; $w_2(y_o) = R(z_N) + \left(\frac{\eta(1-\rho)}{(1-\eta\rho)} \right) \delta R$; and $w_2(y_F) = R(z_N)$.

Step 2

Given the principal's implementation strategy, the manager's reporting strategy must maximize her expected second period wages. Let $Ew_2(\hat{\theta}_i; z_k, \theta_j)$ represent the manager's expected second period wage by reporting $\hat{\theta}_i$, when the manager is of type z_k and gets state signal θ_j , for $i, j = G, B, o$ and $k = T, N$.

Consider the incentives of a more talented manager first.

$$Ew_2(\hat{\theta}_G; z_T, \theta_G) = p(IP / \hat{\theta}_G)w_2(y_S) + p(NP / \hat{\theta}_G)w_2(y_o) = R(z_T), \quad (1)$$

(because the principal's equilibrium implementation strategy involves $p(IP / \hat{\theta}_G) = 1$).

$$Ew_2(\hat{\theta}_B; z_T, \theta_G) = p(NP / \hat{\theta}_B)w_2(y_o) + p(IP / \hat{\theta}_B)w_2(y_S) = R(z_N) + \left(\frac{\eta(1-\rho)}{(1-\eta\rho)} \right) \delta R \quad (2)$$

(because the principal's equilibrium implementation strategy involves $p(NP / \hat{\theta}_B) = 1$).

$$Ew_2(\hat{\theta}_O; z_T, \theta_G) = R(z_N) \quad (3)$$

The last equation reflects the principal's out-of-equilibrium belief of the manager being more talented on observing a null state signal is zero (i.e., $\mu_1(\cdot, z = z_T / \hat{\theta}_O) = 0$), and hence, her best response of offering the manager a second period wage of $R(z_N)$, the expected marginal product of the less talented manager. Therefore, the manager will have to go to the external labor market to get a higher wage of $w_2(y_o)$, which is based on the market's observation of the project outcome, y_o . However, because this is the only case when the principal's second period wage offer does not match the external market's offer, the manager will quit the firm only in this case (on the assumption that if the manager gets from her incumbent employer the same second period market wage, she would prefer to stay with her current employer). Therefore, this very act of quitting the firm will reveal the principal's perception of the manager's type to the external market. Hence, the market will in turn revise its second period wage offer down to $R(z_N)$, thus frustrating the manager's attempt to obtain a higher second period wage from another firm.

Comparing expressions (1)–(3) above, the more talented manager does best by reporting the truth on observing a good state signal.

Similar analysis shows that the more talented manager also does best by reporting truthfully the observed bad state signal.

Next, analyze the incentives of a less talented manager by comparing the expected payoffs for the two possible reports.

$$\begin{aligned} Ew_2(\hat{\theta}_G; z_N, \theta_O) &= p(IP / \hat{\theta}_G) \{ p(y_S / IP, z_N) W_2(y_S) + p(y_F / IP, z_N) W_2(y_F) \} + p(NP / \hat{\theta}_G) W_2(y_o) \\ &= \rho\phi R(z_T) + (1 - \rho\phi) R(z_N) = R(z_N) + \rho\phi \delta R \end{aligned} \quad (4)$$

$$\begin{aligned} Ew_2(\hat{\theta}_B; z_N, \theta_O) &= p(NP / \hat{\theta}_B) W_2(y_o) + p(IP / \hat{\theta}_B) \{ p(y_S / IP, z_N) W_2(y_S) + p(y_F / IP, z_N) W_2(y_F) \} \\ &= W_2(y_o) = R(z_N) + \left(\frac{\eta(1-\rho)}{(1-\eta\rho)} \right) \delta R \end{aligned} \quad (5)$$

By condition (C1) in Proposition 2, $\left(\frac{\eta(1-\rho)}{(1-\eta\rho)} \right)$ is greater than $\rho\phi$ and hence, the less talented manager will prefer reporting a bad state on observing a null state signal to reporting a good state. As before, applying the argument used in deriving equation (3),

$$Ew_2(\hat{\theta}_O; z_N, \theta_O) = R(z_N) \quad (6)$$

Comparing expressions (4)–(6) above, the less talented manager prefers to report a bad state on observing a null state signal. Further, step 4 demonstrates why the less talented manager will never

deviate from her equilibrium reporting strategy, given the principal's "credible updating rule" in a PSE.

Step 3:

In this step, it is shown that given the manager's reporting strategy, the principal's equilibrium response maximizes her expected welfare over both periods. Note that the principal's first period objective function of maximizing $E\Pi^1(.) + E\Pi^2(.) - E[W_2]$ reduces to implementing the project if and only if $E\Pi^1(.) > 0$ because the project lasts for only one period, the distribution of the second period state is independent of the distribution of the first period state, the manager commits to stay with the firm for only one period, and the feature that in a competitive labor market the manager's wage in any period is equal to her expected marginal product.

Given the manager's reporting strategy, $E\Pi(IP/\hat{\theta}_G) > 0 = E\Pi(NP/\hat{\theta}_G)$ because $p(y_s/\theta_G, z_T) = 1$ and $y_s > 0$. Therefore, the principal does best by implementing the project on obtaining $\hat{\theta}_G$. The expected payoffs for the principal when she implements the project after receiving a bad state report are

$$E\Pi(IP/\hat{\theta}_B) = p(\theta = \theta_G, z = z_T/\hat{\theta}_B)y_s + p(\theta = \theta_B, z = z_T/\hat{\theta}_B)y_F + p(\theta = \theta_G, z = z_N/\hat{\theta}_B)\phi y_s \\ + \{p(\theta = \theta_G, z = z_N/\hat{\theta}_B)(1-\phi) + p(\theta = \theta_B, z = z_N/\hat{\theta}_B)\}y_F = y_F + \left(\frac{(1-\eta)}{(1-\eta\rho)}\right)(\rho\phi)\delta y < 0,$$

by condition (C2). Therefore, the principal will not implement the project on obtaining a bad state report, $\hat{\theta}_B$.

Finally, given the principal's out-of-equilibrium belief that $\mu_1(., z = z_T/\hat{\theta}_O) = 0$, on receipt of the manager's report $\hat{\theta}_O$, she will implement the project (off the equilibrium path) if $\Pi(z_N, \theta_O) = \rho(\phi y_s + (1-\phi)y_F) + (1-\rho)y_F = y_F + \rho\phi\delta y > 0$ and will not implement the project (again, off the equilibrium path) if $\Pi(z_N, \theta_O) = y_F + \rho\phi\delta y < 0$.

Step 4:

Redefine the types of managers as follows: The new set of manager types is $T = Z \times \Theta$. Now, $T = \{z_{TG}, z_{TB}, z_{NO}\}$, $z_T = \{z_{TG}, z_{TB}\}$ and $z_N = \{z_{NO}\}$. The updating rule is not "credible," if there exists a set of manager types K such that if deviation is taken as a signal that $z \in TK$, then $z \in TK$ wishes to deviate and $z \in K$ does not wish to deviate. The sequential equilibrium must have a credible updating rule in order to be a PSE. Hence, to establish that the proposed equilibrium is a PSE, one has to show that there exists no "self-signaling" subset of types K . The unsent message in equilibrium is $\hat{\theta}_O$.

- i) Let $K = \{z_T\}$. Then, $TK = \{z_N\}$. If $z \in TK$, then $z = z_N$. Here, the principal's best response as a function of her updated beliefs about this deviation is $a^* = IP$ if $\Pi(z_N, \theta_O) > 0$ and $a^* = NP$ if $\Pi(z_N, \theta_O) < 0$. But $EW_2^*(z_N) > EW_2(z_N, \hat{\theta}_O, a^*)$. Hence, $K \neq \{z_T\}$. That is, z_N does not wish to deviate in equilibrium.
- ii) Let $K = \{z_N\}$. Then, $TK = \{z_T\}$. If $z \in TK$ and $z = z_{TG}$, then $a^* = IP$ and if $z = z_{TB}$, then $a^* = NP$. $EW_2^*(z_T) = EW_2(z_{TG}, \hat{\theta}_O, a^*)$ and $EW_2^*(z_{TB}) < EW_2(z_{TB}, \hat{\theta}_O, a^*)$, but then z_N also wants to be in TK . That is, any deviation to the unsent message by the more talented manager will be mimicked by the less talented manager. Hence, $K \neq \{z_N\}$.
- iii) Let K be empty, i.e., $K = \Phi$. Then, $TK = T = \{z_{TG}, z_{TB}, z_{NO}\}$. Given that z_N wants to deviate neither z_{TG} nor z_{TB} will find it beneficial to deviate. Hence, $K \neq \Phi$. So, the updating rule and the beliefs are "credible." Hence, the proposed equilibrium is a PSE.

The conjectured equilibrium is unique because no pooling equilibrium would satisfy the above requirements of a PSE as in the above step and any other partial pooling equilibrium strategy is dominated. ■

Proof for Proposition 3: (sketch)

Following the scheme used in the proof for Proposition 2, this PSE is established in four steps. Now consider a setting in which $\phi \geq \gamma$ (condition (C3) is met).

Step 1:

Given the manager's reporting strategy, the principal's equilibrium posterior beliefs at the first stage on obtaining the manager's report can be derived through Bayesian updating as follows:

$$\begin{aligned}\mu_1(\theta = \theta_G, \cdot / \hat{\theta}_G) &= \left(\frac{\eta\rho + (1-\eta)q\rho}{\eta\rho + (1-\eta)q} \right); \mu_1(\theta = \theta_G, z = z_T / \hat{\theta}_G) = \left(\frac{\eta\rho}{\eta\rho + (1-\eta)q} \right); \\ \mu_1(\theta = \theta_G, z = z_N / \hat{\theta}_G) &= \left(\frac{(1-\eta)q\rho}{\eta\rho + (1-\eta)q} \right); \mu_1(\theta = \theta_B, z = z_N / \hat{\theta}_G) = \left(\frac{(1-\eta)q(1-\rho)}{\eta\rho + (1-\eta)q} \right); \\ \mu_1(\theta = \theta_B, z = z_T / \hat{\theta}_B) &= \left(\frac{\eta(1-\rho)}{\{\eta(1-\rho) + (1-\eta)(1-q)\}} \right); \\ \mu_1(\theta = \theta_B, z = z_N / \hat{\theta}_B) &= \left(\frac{(1-\eta)(1-q)(1-\rho)}{\{\eta(1-\rho) + (1-\eta)(1-q)\}} \right); \\ \mu_1(\theta = \theta_B, \cdot / \hat{\theta}_B) &= \left(\frac{\eta(1-\rho) + (1-\eta)(1-q)(1-\rho)}{\{\eta(1-\rho) + (1-\eta)(1-q)\}} \right);\end{aligned}$$

and the off equilibrium path belief, $\mu_1(\cdot, z = z_T / \hat{\theta}_o) = 0$. More specifically,

$$\mu_1(\theta = \theta_G, z = z_N / \hat{\theta}_o) = \rho \text{ and } \mu_1(\theta = \theta_B, z = z_N / \hat{\theta}_o) = 1 - \rho.$$

The market's posterior equilibrium beliefs about the manager being talented at the second stage on observing the project outcome are derived through Bayesian updating as follows:

$$\mu_2(z_T / y_S) = \left(\frac{\eta}{\eta + (1-\eta)\phi q} \right); \mu_2(z_T / y_F) = 0; \text{ and } \mu_2(z_T / y_o) = \left(\frac{\eta(1-\rho)}{\{\eta(1-\rho) + (1-\eta)(1-q)\}} \right).$$

The expected wages for the more talented manager from adopting different strategies can be computed from the above market's posterior beliefs and the optimality of equilibrium strategies of the more talented manager can be established following the lines similar to the proof for Proposition 2.

In contrast to the earlier equilibrium, there exists no pure strategy which maximizes the less talented manager's expected payoffs. Suppose that $q = 0$ in equilibrium. That is, the less talented manager never reports the good state in equilibrium. Then, the consistent equilibrium posterior belief by the market on observing y_S will change to one and

$$Ew_2(\hat{\theta}_G; z_N, \theta_o) = R(z_N) + \rho\phi\delta R < Ew_2(\hat{\theta}_B; z_N, \theta_o) = R(z_N) + \left(\frac{\eta(1-\rho)}{1-\eta\rho} \right)\delta R.$$

But this violates Condition (C3). Hence, q cannot be equal to zero in equilibrium.

Suppose that $q = 1$ in equilibrium. That is, let the less talented manager always report the good state. Then, the consistent equilibrium posterior belief by the market on observing y_S will change

to $\left(\frac{\eta}{\eta + (1 - \eta)\phi}\right)$ and on observing y_o , the market's posterior belief that the manager is talented will increase to one. Hence,

$$Ew_2(\hat{\theta}_G; z_N, \theta_O) = R(z_N) + \left(\frac{\eta\rho\phi}{\eta + (1 - \eta)\phi}\right)\delta R < Ew_2(\hat{\theta}_B; z_N, \theta_O) = G(z_T).$$

This implies that the strategy of always reporting the good state does not maximize the less talented manager's expected payoff. Hence, there exists no pure strategy which maximizes the less talented manager's expected payoff.

The expected payoff of a less talented manager from reporting the good state with probability q and the bad state with probability $1 - q$ is $q Ew_2(\hat{\theta}_G; z_N, \theta_O) + (1 - q) Ew_2(\hat{\theta}_B; z_N, \theta_O)$. The less talented manager will choose that q which will maximize the value of the above expression. Taking the derivative of the above expression with respect to q and setting it equal to zero,

$$q = \left\{ \frac{\sqrt{\phi\rho}(1 - \rho\eta) - \eta(1 - \rho)}{\sqrt{\phi\rho}(1 - \eta) + (1 - \rho)(1 - \eta)\phi} \right\}.$$

Note that q lies strictly between zero and one.¹⁶

Steps 2 and 3:

Next examine the sequential rationality of the principal's strategy.

$$\begin{aligned} E\Pi_2(IP/\hat{\theta}_B) &= \mu_1(\theta = \theta_G, z = z_N/\hat{\theta}_B)\phi y_S \\ &+ \left\{ \mu_1(\theta = \theta_B, z = z_T/\hat{\theta}_B) + \mu_1(\theta = \theta_B, z = z_N/\hat{\theta}_B) + \mu_1(\theta = \theta_G, z = z_N/\hat{\theta}_B)(1 - \phi) \right\} y_F \\ &= y_F + \left(\frac{(1 - \eta)(1 - q)}{\{\eta(1 - \rho)\} + \{(1 - \eta)(1 - q)\}} \right) (\rho\phi) \delta y < 0 \end{aligned}$$

by Condition (C4). Hence, the principal will not implement the project on the receipt of the bad state report. Next,

$$\begin{aligned} E\Pi_2(IP/\hat{\theta}_G) &= \left\{ \mu_1(\theta = \theta_G, z = z_T/\hat{\theta}_G) + \mu_1(\theta = \theta_G, z = z_N/\hat{\theta}_G)\phi \right\} y_S \\ &+ \left\{ \mu_1(\theta = \theta_G, z = z_N/\hat{\theta}_G)(1 - \phi) + \mu_1(\theta = \theta_B, z = z_N/\hat{\theta}_G) \right\} y_F \\ &= y_F + \left(\frac{\rho\{\eta + (1 - \eta)q\phi\}}{\eta\rho + (1 - \eta)q} \right) \delta y > 0 \end{aligned}$$

by Condition (C5). Hence, the principal will implement the project on the receipt of the good state report.

Step 4:

As in Step 4 in the proof for Proposition 2, again fix the unsent message in this equilibrium as $\hat{\theta}_O$. As before, one can show that there exists no set K such that all manager types in K do not wish to deviate with all manager types in $T \setminus K$ wishing to deviate, when the principal believes that

¹⁶ Using an argument similar to the one used in deriving expression (3) in the proof for Proposition 2, one can show that the less talented manager will not like to separate out herself by reporting the null state signal.

any deviation comes only from types in $T \setminus K$. Thus, there exists no manager type who wishes to deviate in a “self-signaling” fashion. Hence, the PSE. The uniqueness of the above PSE follows from arguments similar to those made in the proof for Proposition 2. ■

Proofs for Corollaries 3.1 and 3.2:

The desired relationships are established by signing the derivatives of the variables of interest with respect to the specific parameters. ■

Proof for Proposition 4:

Compare the net expected wealth of the principal in the first-best setting with the one obtained in the second-best setting. ■

Proof for Proposition 5:

The proof follows the lines of proofs for Propositions 2, 3 and 4 and hence, is omitted here. ■

References

- Baiman, S., and J. H. Evans III. 1983. Predecision information and participative management control systems. *Journal of Accounting Research* (Autumn): 371-395.
- Chò, I., and D. Kreps. 1987. Signaling games and stable equilibria. *The Quarterly Journal of Economics* (May): 179-221.
- Conroy, R., and J. Hughes. 1987. Delegating information gathering decisions. *The Accounting Review* (January): 50-66.
- Dye, R. 1988. Earnings management in an overlapping generations model. *Journal of Accounting Research* 26: 195-235.
- Farrell, J. 1986. Credible Neologisms in Games of Communication. Mimeo, Massachusetts Institute of Technology, Cambridge, Massachusetts.
- Grossman, S., and M. Perry. 1986. Perfect sequential equilibrium. *Journal of Economic Theory*: 97-119.
- Holmstrom, B., and J. Ricart i Costa. 1986. Managerial incentives and capital management. *Quarterly Journal of Economics* (Nov.): 835-860.
- Kanodia, C., R. Bushman, and J. Dickhaut. 1989. Escalation errors and the sunk cost effect: An explanation based on reputation and information asymmetries. *Journal of Accounting Research* (Spring): 59-77.
- Kreps, D. M., and R. Wilson. 1982. Sequential equilibria. *Econometrica* (July): 863-894.
- Magee, R. P. 1986. *Advanced Managerial Accounting*. New York: Harper and Row.
- Myerson, R. B. 1979. Incentive compatibility and the bargaining problem. *Econometrica*: 61-74.
- . 1986. Credible Negotiation Statements and Coherent Plans. Working Paper, Northwestern University.
- Narayanan, M. P. 1985. Managerial incentives for short-term results. *Journal of Finance*: 1469-1484.
- Sappington, D. 1983. Limited liability contracts between principal and manager. *Journal of Economic Theory* 29: 1-21.
- Scharfstein, D. S., and J. C. Stein. 1990. Herd behavior and investment. *American Economic Review* (June): 465-479.
- Verrecchia, R. 1983. Discretionary disclosure. *Journal of Accounting and Economics* 5: 179-194.

The Economic Consequences of SFAS 106 in Rate-Regulated Enterprises

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SYNOPSIS AND INTRODUCTION: This study investigates the impact of the Financial Accounting Standards Board (FASB) Statement of Financial Accounting Standards No. 106, "Employers' Accounting for Postretirement Benefits Other Than Pensions" (FASB 1990, hereinafter, SFAS 106) for a sample of rate-regulated public utility firms. The results of a recent study by Espahbodi et al. (1991) of the market reaction to the issuance of the exposure draft for SFAS 106 suggest that, for a sample including both regulated and non-regulated firms, investors perceived the required disclosures as value-decreasing due to higher contracting costs. However, the unique institutional setting for rate-regulated firms implies that while a similar negative market reaction may result for some regulated firms, there is also a theoretical basis for predicting either no market reaction or a positive reaction to the proposed accounting standard.

The no reaction hypothesis is motivated by the nature of the relationship between regulatory rate-setting process and special external financial reporting procedures; as a result, some regulated firms may be sheltered from the indirect costs attributed to SFAS 106. A prediction of a positive market reaction arises from the notion that accounting rules can have an effect on the way regulators set rates, resulting in a direct (positive) cash flow effect for some of the sample firms.

Our results suggest that investors in public utilities did not, on average, view the proposed standard as a value-decreasing event. This result is in sharp contrast to the Espahbodi et al. (1991) finding of a large negative average reaction for firms affected by SFAS 106. We also find evidence that the market reaction at the exposure draft announcement varies cross-sectionally based on the market's ex ante expectation of regulators' actions and the resulting changes in revenues from

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the adoption (or non-adoption) of the accounting rule for ratemaking purposes. The results thus add to a growing body of literature which demonstrates differences in the market's assessment of accounting information across regulated and non-regulated industries. More importantly, the results point to the role of regulatory response in the market's assessment of impending accounting changes in regulated industries .

Key Words: *SFAS 106, Postretirement benefits, Utilities, Regulated industries, Regulatory accounting.*

Data Availability: *All data, except the regulatory rankings, are available from public sources.*

THE remainder of this article is organized as follows. Section I describes the changes required by SFAS 106 and how they affect financial reporting and the values of non-regulated firms. In section II, we discuss the unique aspects of the rule for public utilities, propose three possible consequences of SFAS 106 for rate-regulated firms, and develop the testable hypothesis. The research design and empirical results of the market reaction tests are described in sections III and IV; section V summarizes the study.

I. Economic Consequences of SFAS 106 for Non-Regulated Firms

SFAS 106 requires employers to accrue the cost of postretirement benefits other than pensions (OPEB) by 1993. Recognition of an annual accrued expense is based on the employees' earned amount of expected future benefits, the accretion of the accumulated plan benefit obligation, and recognition of a transition liability, either over a 20-year amortization period or immediately. Estimates of the total expected future benefits in this calculation must include an inflation factor for health care costs. Because of the magnitude of the costs and the fact that most health plans are unfunded, the standard has significantly affected the balance sheets and income statements of firms which have adopted the rule.¹ In addition to the financial statement effects, substantive reductions in benefit plans have been attributed to the enactment of SFAS 106. However, firms attempting to renege on benefit promises are increasingly facing court challenges.²

Espahbodi et al. (1991) suggest that although there are no direct cash flow or tax implications for the standard, there may be significant indirect economic consequences via debt covenant effects, and restrictions on optimal contracting technology. They test the market reaction to nine events in the deliberation period and find significant negative abnormal returns at the exposure draft date for 143 sample firms affected by SFAS 106. The effect was more pronounced for firms that were less mature (in terms of work force age), smaller, and more highly levered. They interpret this evidence to be consistent with the notion that the negative contracting cost effect dominates the positive political cost effect.

¹ Using firm-specific data and demographic information available prior to adoption of SFAS 106, Warshawsky et al. (1993) estimate that the after-tax earnings of a large sample of firms sponsoring retiree health plans will drop, on average, by 35% in the year of adoption, if the transition obligation is amortized over 20 years. Similarly, they estimate the median liability under SFAS 106 to be 3.1% of total assets and 5.8% of the market value of common stock. The financial press has recently reported the actual effects of early adoption of SFAS 106 to be of a similar magnitude. See for example *The Wall Street Journal*, April 22, 1992, pp. C1-C2.

² See *Business Week*, December 10, 1990, 34.

II. Expected Impact of SFAS 106 on Utility Accounting and Ratemaking

The Relationship Between Accounting Standards and Rate Regulation

The revenues allowed a firm by regulators in the ratemaking process are determined in most cases by the following general formula:

$$\text{Revenues} = \text{Operating Expenses} + \text{Depreciation} + \text{Taxes} + (\text{ROR} * \text{Total Assets}),$$

where ROR is the "fair rate of return" allowed to pay interest to the bondholders and a return on equity to the shareholders. ROR is commonly estimated by computing the weighted average cost of equity and debt capital. For the determination of expenses and assets in this formula, publicly-traded regulated utilities follow generally accepted accounting principles (GAAP). However, regulators occasionally order departures from GAAP in order to defer the recognition of costs that are considered abnormal or that have benefits applicable to future rates (Deloitte, Haskins & Sells 1988). The FASB formally recognized the unique relationship between rate-regulated firms' cash flows and their accounting methods in SFAS 71 (FASB 1982), which allows certain modifications of GAAP for external reporting where the ratemaking process differs from the historical cost model. If a firm meets the criteria of SFAS 71, the standard permits the capitalization of costs that are ordinarily charged against income in a non-regulated firm.³ Such capitalized costs are referred to as deferred assets or regulatory assets, and represent the promise of the regulator to include the cost in allowed revenues at a future time. For example, SFAS 71 (para. 48-49) allows regulated firms to create an asset offsetting the liability for accrued compensated absences if it is probable that future regulatory treatment will allow the inclusion of the paid cost in future revenues granted to the firm.

The FASB explicitly acknowledged in SFAS 106 that the regulatory treatment of postretirement health costs may give rise to a regulatory asset equal to the difference between the accrued cost and the amount recovered in the current rates allowed, noting that actions of the regulator can change the timing of recognition of the cost as an expense (FASB 1990, para. 364). Thus, assuming SFAS 71 applicability, a utility which continues to receive OPEB cost reimbursement on a cash basis⁴ can counter-balance the effects of an unfunded SFAS 106 liability with a deferred regulatory asset, an accounting treatment in direct contrast to the application of SFAS 106 in non-regulated firms.⁵ Thus, special industry accounting rules may have the effect of sheltering rate-

³ The criteria for a firm to qualify for SFAS 71 reporting are:

- a. The enterprise's rates for regulated services or products provided to its customers are established by or subject to approval by an independent, third-party regulator...
- b. The regulated rates are designed to recover the specific enterprise's costs of providing the regulated services or products.
- c. In view of the demand for the regulated services or products and the level of competition, direct and indirect, it is reasonable to assume that rates set at levels that will recover the enterprise's costs can be charged to and collected from customers. This criterion requires consideration of anticipated changes in levels of demand or competition during the recovery period for any capitalized costs (SFAS 71, para. 5).

⁴ The terms "cash basis" and "pay-as-you-go" have been used to describe the accounting for OPEB costs prior to SFAS 106. We use these terms interchangeably in this study.

⁵ It should be noted that the applicability of SFAS 71 to OPEB costs created a substantial amount of controversy subsequent to the enactment of the new rule. The Securities and Exchange Commission expressed concern about the uncertainty of future recovery of OPEB regulatory assets recorded by some registrants, and the FASB formed an Emerging Issues Task Force (EITF) to study the issues. In 1993 the EITF reached a consensus on the following issues: (1) that a firm may not record a regulatory asset if the regulator continues ratemaking based on pay-as-you-go costs, and (2) that all SFAS 106 costs (including the amortization of the transition obligation) must be included in rates within five years for a firm to qualify for a regulatory asset (FASB 1993).

regulated firms from most of the financial statement effects anticipated for non-regulated firms adopting SFAS 106.

While the special provisions of SFAS 71 may mitigate the financial statement effects which give rise to the hypothesized indirect cash flow effects, direct (and indirect) cash flow implications cannot be ruled out, since the potential exists for the accounting standard to affect the determination of actual revenues by the regulator. During the deliberation period for SFAS 106, pro-consumer groups argued against accrual-based accounting on the basis that regulators might be persuaded by utilities to base future utility rates on GAAP-based OPEB costs, rather than actual cash outlays. These lobbyists alleged that utility customers would face higher rates and utilities would receive current cash flows for future outlays. This concern led a consumer advocacy group, in its comment letter on the SFAS 106 exposure draft, to suggest that if the accrual basis is adopted for both reporting and ratemaking, utility firms should be required to put any additional revenues in a trustee account which could be used only for retiree benefit payments.

On the other hand, utility firms and their advocates lobbied heavily for accrual accounting. According to Norris (1991), utilities favor accrual for both theoretical and practical reasons. First, accrual accounting for OPEB is consistent with the ratemaking goal of intergenerational equity, i.e., it matches the cost to the period when the benefit is earned by the employee, such that current customers are funding current costs. Second, accrual-based ratemaking will reduce long-term costs because cash received from rates can be invested in earning assets to offset future cash benefit payments.

Based on the theoretical predictions of the economic consequences literature, the range of possible regulatory responses to the rule, and the positions taken by lobbyists, we propose that the market's expectations concerning the cash flow effects of SFAS 106 can be divided into three categories, each of which leads to a predicted stock price effect at the exposure draft announcement.

Accrual reporting, cash basis ratemaking, offsetting regulatory asset. In this case, SFAS 106 is adopted for external GAAP reporting, but the cash basis is continued for ratemaking, and a regulatory asset in accordance with SFAS 71 is created to offset any unfunded OPEB liabilities. Because of the regulatory asset, there are no material financial statement or cash flow effects. Based on the comment letters received during deliberations, this is the alternative favored by pro-consumer lobbyists. Theory suggests that there will be no systematic market revision of expected firm values in this case, since there are no direct or indirect cash flow effects from the implementation of the rule.⁶

Accrual reporting and accrual basis ratemaking. Under the second alternative, which is favored by the utilities, the accrual method is adopted for both accounting and ratemaking. In this case there are no material financial statement effects, since the accrual-based annual expense is recovered in rates, and the transition obligation is offset by a regulatory asset. However, there are potential positive cash flow implications for the utilities. Under accrual-based ratemaking, the firm is allowed to collect revenues from customers equal to the accrued expense rather than the

⁶ When equal amounts are added to both assets and liabilities, net assets are unchanged but financial ratios (e.g., debt to equity ratio) rise. However, there is no anecdotal evidence to suggest that utility firms, their investors, or bond rating services expect this effect to have a material impact on the future cash flows of these firms. We test this notion empirically in this study. For expositional convenience we use the term "immaterial financial statement effects" to distinguish between the firms allowed to record a regulatory asset and those who are not.

smaller cash basis amount. If the regulator does not require all excess funds to be placed in trust, the firm experiences an increase in discretionary cash flows.⁷ If the market expects this alternative to prevail, then the predicted stock price change at the exposure draft date is positive.

Accrual reporting, cash basis ratemaking, no offsetting regulatory asset allowed. In the third case, the regulator continues the cash basis for ratemaking and the firm adopts accrual basis reporting (as in alternative 1), but a regulatory asset is not allowed, resulting in lower reported earnings and increased liabilities which are not balanced by a regulatory asset. In this case, the firm is subject to the same indirect cash flow consequences that have been suggested for its non-regulated counterparts. In addition, there may also be direct cash flow effects. Standard & Poor's (1992) speculates that firms' cash flows may decline if the resulting reduction in equity lowers the weighted cost of capital such that the allowed revenues based on a fair rate of return decline.⁸ If this alternative is expected by investors, we predict that utility firms will experience negative stock price changes at the exposure draft date, since they are subject to indirect effects similar to non-regulated firms and direct cash flow effects from cost-of-capital changes.⁹

In summary, the above discussion suggests that the price reaction around the exposure draft date may depend on a utility's regulatory environment. A zero or positive market reaction at the exposure draft issuance date is expected for public utilities if investors expect alternatives one and two as the most likely regulatory outcomes.¹⁰ As an additional test of this hypothesis, we analyze the market reaction conditioned on differences in the expected treatment of SFAS 106 in the regulatory process. The prediction is that public utilities operating in a favorable regulatory environment (defined below) should exhibit a positive reaction relative to those operating in neutral or unfavorable regulatory environments.

III. Research Design

This study uses an interrupted time-series design to study the effects of SFAS 106 around the exposure draft issuance for a sample of rate-regulated public utilities. A test of the average effects for the entire sample allows inferences about the industry-wide reaction to the rule. However, because such a test may obscure cross-sectional return differences among firms, a weighted portfolio regression model suggested by Sefcik and Thompson (1986) is also used to examine the

⁷ This assertion is one of the major arguments set forth by consumer lobbyists, i.e., if the firm receives discretionary cash flows for OPEB costs in advance of the actual cash outlay, the funds might be used for general corporate purposes or shareholder dividends, and not be available to pay for the retiree benefits in the future.

⁸ As noted previously, the revenues allowed to a firm in the ratemaking process are:

$$\text{Revenues} = \text{Operating Expenses} + \text{Depreciation} + \text{Taxes} + (\text{ROR} * \text{Total Assets}),$$

where ROR is the "fair rate of return" allowed. ROR is estimated by computing the weighted average cost of equity and debt capital. Thus, recording an OPEB liability decreases the relative weight of equity (the more costly source of funds) in the determination of ROR, resulting in lower allowed revenues.

⁹ This effect might be reduced in jurisdictions where the regulator recognizes changes in the cost of capital on a prospective basis, due to expected increases in the riskiness of debt and equity. Other regulators calculate cost of capital on a historical basis. Clearly the former method produces the most favorable outcome for firms experiencing higher investor required rates of return. Thus the investor reaction is likely to depend on the anticipated response of the regulator to this issue.

¹⁰ A 1993 survey by the Missouri Public Utilities Commission reported that 25 of 38 reporting regulatory jurisdictions have allowed all or part of the accrual costs to be recovered in rates; seven have continued cash basis ratemaking, but five of these specifically state that they will reconsider SFAS 106 ratemaking in future cases; six have not held any rate hearings on the matter. Of the latter group, several note that they are currently considering the issues. Many of the regulators note that their recent decisions are not precedent-setting policy decisions, and that rate requests will be decided on a case-by-case basis until an official position can be reached through a generic ratemaking process.

relationship between price changes and regulatory environment, after controlling for indirect cash flow consequences.

Sample

The utility sample was selected from all New York and American Stock Exchange firms on the Compustat tape in the SIC codes 4911-4931. The firms were required to have sufficient daily return data on the CRSP tapes to estimate market model regression coefficients as described below. In addition, financial statements from the National Automated Accounting Retrieval System (NAARS) database were examined to determine if the firm offered other postretirement benefits in the test period. Two firms did not offer OPEB for retirees, and eight did not disclose the required data. One firm was removed from the sample because there was news regarding a substantial dividend reduction at the announcement of the exposure draft. The final sample consists of 113 affected firms out of the original 124 Compustat utilities.

Methods

Industry abnormal return performance around the exposure draft issuance is measured by first estimating the coefficients from a market model regression for each firm:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + e_t, \quad (1)$$

where

- R_{jt} = daily stock return for firm j on day t ,
- α_j, β_j = firm-specific parameters,
- R_{mt} = return on an equally-weighted market index on day t , and
- e_t = error term.

The estimation period for equation (1) is the 200-day period ending 15 days prior to the exposure draft issuance date, February 9, 1989.¹¹ The parameters estimated from equation (1) are then used to find the abnormal returns (AR) on each day t in the event period, a three-day trading window centered on February 9, 1989, for each of the J firms:

$$AR_{jt} = R_{jt} - [a_j + (b_j \cdot R_{mt})]. \quad (2)$$

The abnormal returns are averaged over the J firms for each day within the event period to form an average abnormal return (AAR) for each day,

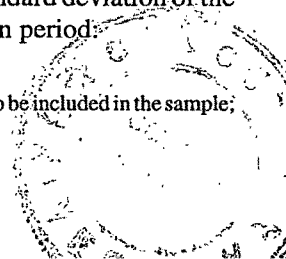
$$AAR_t = 1/J \sum AR_{jt}, \quad (3)$$

and then summed over the three days in the event period to form the cumulative average abnormal return (CAAR),

$$CAAR = \sum AAR_t. \quad (4)$$

Following Dodd et al. (1984), the significance of the CAAR is tested using a test statistic formed by dividing the CAAR by the product of the square root of three and the standard deviation of the times series of average abnormal returns for the 200 days in the estimation period:

¹¹ Complete return data for the 200-day estimation period was not a requirement for a firm to be included in the sample; one firm had a missing return for one day during the estimation period.



$$t\text{-stat} = \text{CAAR} / [\sqrt{3} \cdot \sigma]. \quad (5)$$

This statistic is distributed according to the student t-distribution with 199 degrees of freedom. The t-statistic assumes that the AAR_t are normal and independent through time, but allows for potential cross-sectional dependencies in assessing the average effect of SFAS 106 on the sample firms.

Cross-sectional differences and the relationships between returns and firm-specific variables are measured using a weighted portfolio return model (WPRM) of Sefcik and Thompson (1986).¹² This method involves estimation of a series of time-series regressions of the form:

$$\text{WR}_{pt} = \alpha_p + \beta_p R_{mt} + \gamma_p D_t + e_{pt}, \quad (6)$$

where

- WR_{pt} = weighted portfolio return on day t in the calendar year of the event,
- α = intercept term,
- β = slope parameter multiplying the market return on day t ,
- γ = event parameter measuring abnormal return on the event day,
- R_{mt} = equally-weighted return on the market portfolio on day t ,¹³
- D_t = 1 during the three days centered on the event, 0 otherwise,
- e_{pt} = error term.

The weighted portfolio return for the J firms is calculated by first forming a $J \times K$ matrix of firm characteristics, F , which consists of a column of 1s and $(K-1)$ columns of characteristics. Next, a $T \times J$ matrix of daily firm returns, R , is multiplied by a $J \times K$ weight matrix, W' , the transpose of $W = (F'F)^{-1}F'$. The resulting $T \times K$ matrix consists of K column vectors of weighted portfolio returns which are the dependent variables in each of the K regressions specified by equation (6). The first column is denoted as the "intercept portfolio" returns and the estimate of the event parameter (γ) reflects the industry-wide market effects unrelated to the firm characteristics. The event parameters estimated in the remaining regressions can be interpreted as the market effects in "pseudo-portfolios" consisting of firms with only a single characteristic, and measure the relationship between abnormal returns and the characteristic.

The variable of interest in this study is the regulatory environment variable (REGENV), which proxies for differences in the expected treatment of SFAS 106 in the regulatory process. It is based on rankings of state regulatory jurisdictions made on a quarterly basis by Argus Associates, a private research service. REGENV is a dummy variable coded one if the firm is primarily regulated in a jurisdiction that is considered favorable to utilities, zero if it is in an average environment, and -1 if the regulator is unfavorable to firms. These rankings are based on a proprietary model which evaluates, from an investor's standpoint, the actions and philosophies of regulatory commissions, legislatures, and courts in each of the states. Included are such factors as return on equity granted, the regulator's concern for the financial integrity of the firm, punitive actions imposed, percentage of requested revenue granted, method of rate base valuation, and the overall policies in dealing with industry issues.¹⁴ Previous utility studies in finance have

¹² Sefcik and Thompson (1986) demonstrate that this method is equivalent to the more familiar cross-sectional regression of cumulative abnormal firm returns on firm-specific variables, and that this method has the additional advantage of fully accounting for cross-correlations and cross-sectional heteroscedasticity in firms' error terms.

¹³ Use of a value-weighted index does not alter the results

¹⁴ Several investment services (e.g., Value Line, Salomon Brothers, and Duff and Phelps) publish qualitative ranking.

employed these rankings as a classificatory variable to explain cross-sectional variation in firm business decisions or investor market reaction to regulatory events (see Davidson and Chandy 1983; Ferris et al. 1986; Abdel-khalik 1992).

Other firm characteristics used in this study are included to proxy for indirect cash flow consequences, as suggested by Espahbodi et al. (1991). They are the ratio of book value of total liabilities to total assets (DEBT), the natural log of total assets (SIZE), the ratio of pay-as-you-go cash basis costs for OPEB to book value of total assets¹⁵ (PAYG), and a dummy variable (ACCR) coded as one if accrual accounting is used for OPEB and zero otherwise. All these variables were collected from Compustat or NAARS. REGENV, PAYG, and ACCR are for the fiscal year ending in 1988, the year end prior to the exposure draft announcement. SIZE and DEBT are measured as averages over the entire deliberation period (i.e., 1983-1989).¹⁶

IV. Results

Descriptive statistics for the selected variables are shown in table 1. The full sample results are shown in Panel A and the results of subsamples classified by regulatory environment are presented in Panels B, C, and D. The firms are somewhat smaller on average than the firms examined by Espahbodi et al. (1991) and Mittelstaedt and Warshawsky (1992). However, the median pay-as-you-go OPEB cost of \$2 million for our sample is close to the median OPEB cost reported by Mittelstaedt and Warshawsky.

Equally-Weighted Portfolios

The results of the average abnormal return test are shown in Panel A of table 2. The three-day CAAR around the exposure draft issuance date is negative, but quite small, and the t-statistic is not significantly different from zero at a confidence level of .10. Fifty-six percent of the firms had negative abnormal returns and 44 percent had positive abnormal returns. The magnitude of the portfolio abnormal return, -0.34%, is less than one-eighth the size of the three-day abnormal return of -3.02% shown by Espahbodi et al. (1991) for a sample composed primarily of non-regulated firms affected by SFAS 106.¹⁷ These results suggest that on average, investors in regulated utilities, unlike investors in non-regulated firms, did not view the proposed SFAS 106 rules as having any direct or indirect negative cash flow effects. However, the aggregate results may obscure cross-sectional differences in investor expectations about the ultimate cash flow effects.

Panel B presents the abnormal return in subsamples classified according to the regulatory environment. The portfolio of firms in favorable environments has a positive (but insignificant) return, while the group in unfavorable environments has a significantly negative return, and the difference between the two is statistically significant.¹⁸ Thus, contrary to the aggregate portfolio

schemes for regulatory commissions which are based on similar evaluation criteria. Davidson and Chandy (1983) find that the rankings of the various services are highly correlated.

¹⁵ Warshawsky et al. (1993) measure the potential financial statement effects of SFAS 106 as a function of pay-as-you-go OPEB cost and the specific demographic characteristics of individual firms. Since all our sample firms fall under the "stable mature" demographic group characterized as mature companies with a relatively high age, long service and a large number of retirees, we use pay-as-you-go costs to control for potential financial statement effects.

¹⁶ The results are not altered by using the 1988 values for these variables, rather than their means.

¹⁷ Their sample of 143 affected firms contained 20 utilities, 16 of which are common to our sample.

¹⁸ The test statistic for the difference test is:

$$(\text{CAAR}_F - \text{CAAR}_U) / (\sigma_D \cdot \sqrt{3}),$$

where the numerator is the difference in the subsamples' 3-day cumulative average abnormal returns from equation (4), and σ_D is the estimated standard deviation of the subsample AAR differences in the estimation period.

Table 1
Descriptive Statistics for Selected Variables^a

	Panel A: Full Sample (N=113)			Panel B: Sample Firms Operating in a Favorable Regulatory Environment (N=7)			Panel C: Sample Firms Operating in an Average Regulatory Environment (N=86)			Panel D: Sample Firms Operating in an Unfavorable Regulatory Environment (N=20)		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
REGENV	-0.12	0.00	0.48	1.00	1.00	-	0.00	0.00	-	-1.00	-1.00	-
DEBT	0.62	0.62	0.05	0.65	0.63	0.07	0.62	0.62	0.06	0.60	0.60	0.03
ASSETS (in \$ millions)	3855.39	2282.83	4271.82	2923.26	1157.27	4923.03	3723.06	2385.0	3750.07	4750.66	2332.66	5979.92
OPEB Cost ^b (in \$ millions)	5.69	2.00	8.18	7.19	0.72	13.12	5.43	2.00	7.68	6.25	2.00	8.35
PAYG ^b	0.002	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.002
ACCR	0.06	0.00	0.24	0.00	0.00	-	0.035	0.00	0.18	0.20	0.00	0.41
EMPLOYEES (in 000's)	5.72	3.33	6.09	3.58	2.22	4.58	5.58	3.79	5.82	7.05	3.73	7.54

^a Descriptive statistics for DEBT, ASSETS and EMPLOYEES are based on firm means over the 1983-1989 fiscal years. All other variables are measured at the end of 1988.

^b Cash basis postretirement benefits other than pensions costs (OPEB) and PAYG variable are based on 89 firms in Panel A, 7 firms in Panel B, 69 firms in Panel C, and 13 firms in Panel D.

REGENV = 1 if a firm is primarily regulated in a jurisdiction that is considered favorable to utilities, 0 if considered average, and -1 if considered unfavorable.

DEBT = Ratio of book value of total liabilities to total assets.

ASSETS = Book value of total assets.

PAYG = OPEB costs reported in footnotes divided by book value of total assets.

ACCR = 1 if a firm uses accrual accounting for OPEB, 0 otherwise. Only 7 firms used accrual, 3 in the average environment and 4 in the unfavorable environment.

EMPLOYEES = Total number of employees reported on Compustat.

Table 2
Cumulative Abnormal Returns (CAAR) Around the Exposure Draft Date:
Descriptive Statistics and Correlations

	<i>Sample Size</i>	<i>Mean</i>	<i>Portfolio t-statistic^a</i>	<i>First Quartile</i>	<i>Median</i>	<i>Third Quartile</i>	<i>Percent Negative</i>
<i>Panel A: Full sample</i>							
ALL FIRMS	113	-0.34	-1.02	-1.25	-0.18	0.47	56
<i>Panel B: Full sample classified by regulatory environment</i>							
FAVORABLE	7	0.92	1.38	-0.55	0.27	2.25	43
AVERAGE	86	-0.33	-0.93	-1.13	-0.17	0.38	55
UNFAVORABLE	20	-0.85	-1.93 ^c	-2.01	-0.70	0.34	65
Difference test - favorable vs. unfavorable: t-stat.= 2.48 ^b							
<i>Panel C: Univariate correlations for firm-specific variables and cumulative abnormal returns</i>							
	CAAR	REGENV	DEBT	PAYG	ACCR		
REGENV	0.20 ^c						
DEBT	0.05	0.20 ^c					
PAYG	0.04	0.12	-0.17				
ACCR	-0.01	-0.25 ^b	-0.14	-0.19 ^c			
SIZE	-0.23 ^c	-0.09	0.11	-0.12	0.16		

^a This is the test statistic described in the text, which accounts for cross-sectional dependencies.

^b Significant at the 0.01 level (one-tail test).

^c Significant at the 0.05 level (one-tail test).

SIZE is the natural log of total assets, averaged over the 1983-1989 fiscal years. All other firm-specific variables are defined as in table 1.

results, there is evidence that the market reaction to the exposure draft varies with the expected regulatory treatment of the new rule.

Panel C shows the univariate correlations between the abnormal returns and the firm characteristics. Consistent with the results in Panel B, CAAR and regulatory climate are positively correlated. In addition, CAAR and firm size are negatively correlated.

Alternate explanations for the insignificant returns around the exposure draft for the full sample are (1) the market had already impounded the expected effects of the rule prior to the exposure draft announcement, or (2) investors did not revise expectations until the final standard was issued. To rule out these possibilities, we calculate the abnormal returns around the nine events used in Espahbodi et al. (1991) and around the issuance of SFAS 106, and compare the results of the two studies. The events are described in the Appendix, and the test results are shown in table 3. The first column contains the abnormal returns for the equally-weighted utility sample, the second and third columns reproduce the Espahbodi sample results, and the last column shows the Bonferroni procedure joint confidence intervals to infer differences between the utility and Espahbodi experimental sample results.¹⁹

Prior to the exposure draft issuance, event 8, none of the announcements were associated with abnormal returns in the Espahbodi et al. sample. However, the utility sample exhibits a large negative return around event 3. The result is surprising in view of the fact that event 3 is the issuance of a Technical Bulletin by the FASB staff on April 9, 1987, providing guidance on reporting a voluntary switch from pay-as-you-go to accrual accounting, and was not reported in *The Wall Street Journal*. Espahbodi et al. notes that this event was selected in a review of the FASB records and included in the study "for completeness" (p. 334). Since the event appears to contain no information which would lead to a price revision, we examined *The Wall Street Journal* on the days around event 3 to determine if there were other news which would cause utility investor reactions. The only noteworthy occurrence in that time period was a report on April 10, 1987 that stocks had fallen sharply the previous day on expectations of higher interest rates and inflation. Incorporation of the market return in the estimation of abnormal returns should account for the effects of such macro-economic events, and it appears to do so in the Espahbodi et al. sample. However, the use of the market index may not fully capture the market-related movement of utility stocks when there is an expected change in interest rates confounding the information content of an accounting event.²⁰ Because the Technical Bulletin has no apparent cash flow implications, we are reasonably confident that the negative return on this date cannot be attributed to the release of the Technical Bulletin. However, this interpretation clearly has implications for the interpretation of the results at the other events, as we discuss below.

The exposure draft announcement, event 8, is negative and highly significant for the Espahbodi et al. sample, but not for the utility sample. Using the Bonferroni method for estimating joint intervals at a confidence level of .90, we find that the estimated average abnormal returns around the exposure draft date for Espahbodi et al. and our sample lie between -4.01% and -2.03%, and -1.12% and 0.45%, respectively. That is, there is no overlap in the two confidence regions. The result suggests a difference between the expected economic impacts for regulated and non-regulated firms. However, as with event 3, an interest rate change (or other industry-specific news) could be confounding the results.²¹ An examination of *The Wall Street Journal* for the days around event 8 did not reveal any general economic or industry-related news in the event window to account for the difference.

¹⁹ See Neter et al. (1985) for a discussion on Bonferroni joint confidence intervals.

²⁰ It is widely accepted by market participants that utility (and bank) stocks are more interest rate-sensitive than other industries, due to their relatively high leverage. However, previous research which addresses this issue (usually by adding an interest rate index to the expectations model) has not demonstrated any change in results (see, for example, Bowen et al. 1983).

²¹ For example, "good news" such as an expectation of lower interest rates or a prediction of increased demand for electric power might confound the otherwise negative reaction to the accounting rule observed by Espahbodi.

Table 3
Comparison of Portfolio Abnormal Returns of Public Utilities Sample and
Espahbodi et al. (1991) Sample Around Ten Events relating to SFAS 106
(t-statistics in parentheses)

Portfolio Abnormal Returns (in percent)				
Event ^a	Public Utilities Sample (N=113) ^b	Espahbodi et al. (1991)		Bonferroni Interval ^d
		Experimental Sample (N=143)	Control Sample (N=100)	
1	0.35 (0.59)	0.07 (0.17)	-0.14 (-0.65)	
2	-0.29 (-0.62)	0.16 (0.37)	-0.05 (-0.22)	
3	-2.35 (-4.79) ^c	0.46 (1.09)	0.25 (1.15)	-3.52 to -1.18 ^e -0.52 to 1.44 ^f
4	0.87 (0.71)	0.27 (0.64)	0.06 (0.28)	
5	-0.14 (-0.25)	0.13 (-0.24)	-0.08 (-0.37)	
6	0.35 (0.74)	0.07 (0.16)	-0.15 (-0.70)	
7	0.45 (1.36)	-0.51 (-1.19)	-0.08 (-0.36)	
8	-0.34 (-1.02)	-3.02 (-7.10) ^c	0.05 (0.22)	-1.12 to 0.45 ^e -4.01 to -2.03 ^f
9	-0.23 (-0.67)	0.06 (0.13)	-0.15 (-0.66)	
10	0.03 (0.05)	N.R.	N.R.	

^a Events are described in the Appendix.

^b N = 111 for events 1 and 2, N = 110 for event 10

^c Significant at the 0.01 level (one-tail test).

^d The intervals are reported only for events where there is no overlap in the confidence regions of event parameter estimates of the utility sample and the Espahbodi et al. experimental sample.

^e Confidence interval for the utility sample.

^f Confidence interval for the Espahbodi et al. experimental sample.

N.R. = Not Reported

Another potential explanation for the difference in the event 8 results is that the utility sample is less affected by the accounting rule because the relative magnitude of the OPEB is smaller than the firms in the Espahbodi et al. sample. However, this explanation is inconsistent with both the anecdotal and the empirical evidence. Standard & Poor's (1992) asserts that utility OPEB costs are substantial because they have large employee bases, and offer more generous retiree benefits than many other industries. Standard & Poor's notes that the industry has been down-sizing in recent years, and early retirement programs have increased the number of retirees drawing benefits. The firm estimates that the accrued expense will be two to five times larger than costs prior to adoption. In a comment letter on the exposure draft, Duff & Phelps, a utility rating service, notes that implementation will have a large, negative impact on reported earnings, and that debt covenants in existing agreements will have to be rewritten. Price Waterhouse (1993) claims that implementation of SFAS 106 is "expected to significantly affect the utility industry," and selected it as one of the events for analysis in their annual report on major issues facing the industry.

In addition to this anecdotal evidence, the results of a recent academic study also lend support to an assumption of significant effects. Warshawsky et al. (1993) use the change in number of employees 1986-1989 to classify firms into five groups according to the potential magnitude of SFAS 106 effects. We applied this procedure to the utility sample, which results in an employee growth rate of one percent, placing the sample in the "stable mature" group. According to the Warshawsky model, firms in this group are estimated to have accrued expenses 6.46 times as large as their pay-as-you-go costs. In comparison, the least-affected group has a multiple of 3.05 and the most-affected group has a multiple of 9.25; the stable mature group is the second highest of the five.

Weighted Portfolios

Table 4 reports the weighted portfolio regression tests using equation (6).²² The negative return observed around event 3 in the equally-weighted portfolio does not persist in this analysis, which measures the proportion of the return associated with firm characteristics hypothesized to be related to the effect of the accounting rule. Only the event 8 parameter for the portfolio weighted by the REGENV variable is significant at conventional levels. These results suggest three things. First, the market reaction around the exposure draft is related to expected differences in SFAS 106 treatment between regulatory jurisdictions. Second, there are no important cross-sectional differences in market reaction that are related to contracting or political costs, as measured by DEBT and SIZE, respectively. Finally, the two variables which control for the relative magnitude of financial statement effects, ACCR and PAYG, are also unable to explain the cross-sectional differences in market reaction.²³

It is possible, that on any given day, irrespective of any particular event, such as the issuance of the exposure draft, the cross-sectional differences in abnormal returns could be a function of the regulatory regime. To address this possibility, a pseudo event day was randomly selected from 1984-1990, and equation (6) was reestimated by coding D_t as one during the three days centered on the pseudo event day, and zero otherwise. By repeating this entire procedure 1,000 times, we generated an empirical distribution for event parameter estimates for the portfolio weighted by

²² The regression was also estimated by pooling all the time series observations over 1984 to 1989 (as in the Espahbodi et al. study), and adding dummy variables for other events in the deliberation process. The results were similar to those using annual regressions, and are not reported.

²³ Alternative specifications for DEBT, SIZE, and PAYG variables did not alter the results. In addition, no differences were found when the tests were replicated using the value-weighted market index.

Table 4
Coefficient Estimates for Portfolio Regressions with the Dependent Variable
Weighted by Firm Characteristics
(t-statistics in parentheses)

<i>Event^b</i>	<i>Alternative Portfolios^a</i>					
	(1) <i>Intercept Portfolio</i>	(2) <i>REGENV Portfolio</i>	(3) <i>DEBT Portfolio</i>	(4) <i>SIZE Portfolio</i>	(5) <i>PAYG Portfolio</i>	(6) <i>ACCR Portfolio</i>
1	-0.74 (-0.64)	-0.03 (-0.17)	0.98 (0.60)	0.04 (0.35)	-65.60 (-1.72)	0.17 (0.65)
2	0.60 (0.53)	-0.06 (-0.29)	-1.16 (-0.71)	0.00 (0.02)	0.46 (0.01)	-0.04 (-0.14)
3	-0.39 (-0.32)	-0.06 (-0.35)	-0.09 (-0.06)	-0.06 (-0.36)	63.21 (1.54)	-0.28 (-1.14)
4	0.11 (0.09)	-0.02 (-0.15)	2.29 (1.41)	-0.15 (-0.97)	-73.63 (-1.80)	-0.39 (-1.59)
5	-0.90 (-0.95)	0.17 (1.35)	0.68 (0.50)	0.05 (0.60)	19.20 (0.64)	-0.04 (-0.19)
6	-0.71 (-0.76)	-0.18 (-1.44)	0.66 (0.48)	0.05 (0.59)	1.96 (0.07)	-0.15 (-0.64)
7	-0.19 (-0.20)	0.11 (0.89)	0.24 (0.18)	0.03 (0.31)	-13.72 (-0.46)	-0.11 (-0.48)
8	0.17 (0.21)	0.27 (2.56) ^c	0.75 (0.61)	-0.10 (-1.45)	4.94 (0.15)	0.21 (1.00)
9	-0.11 (-0.14)	0.03 (0.27)	-0.80 (-0.66)	0.06 (0.90)	29.61 (0.89)	-0.30 (-1.43)
10	-0.55 (-0.62)	-0.10 (-0.82)	1.05 (0.75)	-0.02 (-0.18)	31.63 (0.84)	-0.10 (-0.46)

^a SIZE is the natural log of total assets, averaged over the 1983-1989 fiscal years. All other firm-specific variables are defined as in table 1.

^b Events are described in the Appendix.

^c Significant at the 0.01 level (one-tail test).

the REGENV variable that captures the relation (if any) between REGENV and returns on any given randomly selected event period. The mean and standard deviation of the t-statistics for pseudo event parameter estimates of the REGENV-weighted portfolio are 0.00001 and 0.964, respectively. The mean statistic is small relative to the standard deviation, and the proportion of positive t-statistics is 50.8 percent. The null hypothesis that t-statistics for the pseudo event

parameter estimates of this portfolio are distributed normally with a zero mean and standard deviation of one could not be rejected, thereby suggesting that in any given randomly selected event period, the variable REGENV does not in fact explain the cross-sectional difference in returns for our sample.

The empirical distribution was also used to determine whether the parameter estimate of event 8 for the REGENV-weighted portfolio reported in table 4 is unusual relative to pseudo event parameter estimates for the REGENV-weighted portfolio. The empirical p-value for event 8 parameter estimate of the REGENV-weighted portfolio is 0.035. This result suggests that the results reported in table 4 were not due to a systematic association between REGENV and returns that is specific to our sample.

V. Conclusion

Industries with special accounting practices, particularly regulated industries where cash flows can be directly affected by changes in GAAP, provide an opportunity to test both indirect and direct economic consequences of a mandated accounting change. This research adds to a growing body of literature in support of differences in the use of accounting information across industries, and points to the role of regulator response in the market's assessment of impending accounting changes. The study documents a statistically insignificant market reaction to the exposure draft of SFAS 106 for the public utility industry as a whole, in contrast with the large negative reaction found for a sample of primarily non-regulated firms by Espahbodi et al. (1991). This result is consistent with the notion that investors viewed the effects of SFAS 106 differently for utility firms since they expected that regulatory assets could be created to offset the annual expense increases under non-regulated enterprise accounting rules. However, examination of the cross-sectional differences in investors' reactions suggests that the industry-wide reaction is a combination of diverse expectations, dependent on the expected regulatory action for a given firm.

The findings also have methodological implications for accounting researchers with respect to sample selection and design. While some studies exclude public utilities (and other regulated industry groups) from their samples because of the presumed material effects of special industry practices on external reports, other studies such as Espahbodi et al. (1991) use a control group methodology. Our study suggests that these practices may indeed be desirable, particularly in the case of studies examining consequences of mandated accounting changes, where special industry practices may cause the effect to be very different from the hypothesized effect.

Appendix
Events Relating to SFAS 106,
Employers' Accounting for Postretirement Benefits Other Than Pensions

<i>Event #</i>	<i>Announcement Date</i>	<i>Description</i>
1	July 5, 1984	FASB proposes a rule requiring companies to disclose in footnotes to financial statements certain descriptive information on postretirement health and life insurance benefits.
2	November 12, 1984	FASB approves a rule (SFAS No. 81) requiring companies to disclose in footnotes to financial statements certain descriptive information on postretirement health and life insurance benefits.
3	April 9, 1987	FASB issues Technical Bulletin 87-1, which provides guidance on how employees should account for a change in method of accounting for nonpension postretirement benefits.
4	November 17, 1987	Employee Benefit Research Institute reports that stock prices could be pushed down if FASB requires firms to show accrued liabilities for retirement health benefits on their balance sheets.
5	May 5, 1988	Announcement that FASB is moving closer to requiring that reserve for future retiree health benefits be charged against earnings. Study of 76 firms by consultant firm, TPF&C, shows that profits could decrease 50 percent for some firms.
6	August 17, 1988	Announcement that FASB will soon propose a rule to require firms to deduct potential medical and insurance benefits for retired employees from earnings.
7	November 22, 1988	Announcement that FASB plans to issue proposed accounting rule later this year. Announcement that LTV Corp. adopted this proposed rule early and recorded \$2.26 billion charge to reflect the potential cost of medical and life insurance benefits for its 118,000 current and retired employees.
8	February 9, 1989	FASB issues Exposure Draft, <i>Employers' Accounting for Postretirement Benefits Other Than Pensions</i> .
9	September 5, 1989	Announcement that Standard & Poor's will not downgrade corporate debt because of reported liabilities from nonpension postretirement benefits.
10	December 19, 1990	Issuance of SFAS No. 106, <i>Employers' Accounting for Postretirement Benefits Other Than Pensions</i> .

Source: Espahbodi et al. (1991)

References

- Abdel-khalik, R. 1992. Managerial incentives and relative performance evaluation under different regulatory regimes. Working paper, University of Florida, Gainesville.
- Berton, L., and R. Brennan. 1992. New medical-benefits accounting rule seen wounding profits, hurting shares. *The Wall Street Journal* (April 22): C1-C2.
- Business Week*. 1990. Bitter choice: Broken promises or broken budgets. (December 10): 34.
- Bowen, R., R. Castanias, and L. Daley. 1983. Intra-industry effects of the accident at Three Mile Island. *Journal of Financial and Quantitative Analysis* 18 (March): 87-111.
- Davidson III, W., and P. Chandy. 1983. The regulatory environment for public utilities: Indications of the importance of the political process. *Financial Analysts Journal* 39 (Nov-Dec): 50-53.
- Deloitte, Haskins & Sells. 1988. *Public Utilities Manual*. New York, NY: Deloitte, Haskins & Sells.
- Dodd, P., N. Dopuch, R. Holthausen, and R. Leftwich. 1984. Qualified opinions and stock prices. *Journal of Accounting and Economics* 6 (April): 3-38.
- Espahbodi, H., E. Strock, and H. Tehranian. 1991. Impact on equity prices of pronouncements related to nonpension postretirement benefits. *Journal of Accounting and Economics* 14 (December): 323-346.
- FASB. 1982. *Statement of Financial Accounting Standards No. 71: Accounting for the Effects of Certain Types of Regulation*. Stamford, CT: Financial Accounting Standards Board.
- . 1990. *Statement of Financial Accounting Standards No. 106: Employer's Accounting for Postretirement Benefits Other than Pensions*. Stamford, CT: Financial Accounting Standards Board.
- . 1993. Emerging Issues Task Force, *EITF Meeting Minutes, Issue No. 92-12, Accounting for OPEB costs by rate-regulated enterprises*. (January 21). Stamford, CT: Financial Accounting Standards Board.
- Ferris, S., D. Johnson, and D. Shome. 1986. Regulatory environment and market response to public utility rate decisions. *Journal of Financial Research* 9 (Winter): 313-318.
- Mittelstaedt, H., and M. Warshawsky. 1992. The impact of liabilities for retiree health benefits on share prices. Working paper, Arizona State University, Tempe.
- Neter, J., W. Wasserman, and M. Kutner. 1985. *Applied Linear Statistical Models*. Homewood, IL: Richard D. Irwin, Inc.
- Norris, J. 1991. Accounting for post-retirement employee benefits. *Public Utilities Fortnightly* 128 (August 15): 32-34.
- Price Waterhouse. 1993. *The Public Utility Industry—1992 Survey of Financial Reporting and Industry Developments*. New York, NY: Price Waterhouse.
- Sefcik, S., and R. Thompson. 1986. An approach to statistical inference in cross-sectional models with security abnormal returns as dependent variable. *Journal of Accounting Research* 24 (Autumn): 316-334.
- Standard & Poor's Corp. 1992. *Standard & Poor's Credit Week* 12 (June 15). New York, NY: Standard & Poor's Corp.
- Warshawsky, M., H. Mittelstaedt, and C. Cristea. 1993. Recognizing retiree health benefits: The effect of SFAS 106. *Financial Management* 22 (Summer): 188-199.

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The Year-End LIFO Inventory Purchasing Decision: An Empirical Test

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SYNOPSIS AND INTRODUCTION: Several analytical models of the year-end inventory purchasing decision of a LIFO firm have been developed (Cohen and Halperin 1980; Halperin 1979, 1981; Biddle and Martin 1985).¹ This study finds empirical support for the prediction of these models that, since only LIFO firms reduce their tax burden by purchasing additional inventory (i.e., "extra" inventory) at year-end, LIFO firms are more likely to purchase extra inventory at year-end than FIFO firms.

This research also provides evidence that high-tax LIFO firms are more likely to purchase extra inventory at year-end than low-tax LIFO firms. This behavior is predicted because a LIFO firm's tax savings from purchasing extra inventory at year-end are increasing in its marginal tax rate. Additional evidence of tax-motivated year-end inventory purchases is offered by tests which find that (1) consistently high-tax LIFO firms accelerated their year-end inventory acquisitions—and thus reduced their taxable income—to a significant degree in the years immediately preceding the reduction in tax rates mandated by the Tax Reform Act of 1986; and (2) differences in tax status are not related to differences in fourth quarter inventory purchasing behavior for FIFO firms.

The results of this study indicate that taxes have a sizable effect on the inventory purchasing policy of LIFO firms. For example, (1) the estimated difference in the percentage of annual inventory purchases made in the fourth quarter between high-

¹ Less formal models of LIFO inventory management are provided in the LIFO liquidation studies of Stober (1986) and Tse (1990).

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tax and low-tax LIFO firms is equivalent, on average, to \$12.66 million of purchases (3.8 percent of ending inventory); and (2) the estimated decrease in inventory purchases made in the fourth quarter by LIFO firms that move from a high-tax status in one year to a low-tax status in the following year is equivalent, on average, to \$28.89 million of purchases (12.1 percent of ending inventory). These large dollar amounts lend credence to the concern that year-end LIFO inventory purchases made for tax purposes may lead to inventory management inefficiencies (Jannis et al. 1980, 186).

Key Words: *LIFO, Tax minimization, Inventory purchasing strategies, Cost of goods sold management.*

Data Availability: *Data are available from the authors.*

THE study proceeds as follows. We review prior analytical models of year-end LIFO inventory acquisition strategies in section I. Section II details test variables, the hypotheses to be tested, and sample selection procedures. The primary test results for LIFO firms are reported in section III, while the results of tests using (1) the response of LIFO firms to the Tax Reform Act of 1986; and (2) FIFO firms are reported in section IV. We summarize our findings in section V.

I. Previous Research on the Year-End LIFO Purchasing Decision

The term “inventory purchases” in the following sections refers to both inventory purchases and inventory production. While all arguments are presented assuming that price levels are increasing, the conclusions drawn carry through to the case of declining price levels if directional predictions are reversed.

The LIFO inventory method allows the deduction of the most recently acquired inventory as cost of goods sold. As a result, a LIFO firm reports a greater cost of goods sold and thus pays less tax if it purchases extra inventory at year-end during a period of rising prices. For this reason, a LIFO firm is predicted to purchase extra inventory at year-end if the taxes saved by purchasing these additional units are greater than their holding cost (Halperin 1981, 978-979 and Cohen and Halperin 1980, 381-386 offer numerical examples). Moreover, LIFO firms with high tax rates are expected to be more likely to purchase extra inventory at year-end than LIFO firms with low tax rates, since the tax savings from purchasing extra LIFO inventory at year-end are increasing in a firm's marginal tax rate.

Further, the purchase of extra LIFO inventory at year-end creates additional layers of ending inventory. When these additional layers are expensed in a future year, the related liquidation income will be less heavily taxed if the firm has experienced a declining marginal tax rate. Thus, it is predicted that a LIFO firm purchases more extra inventory at year-end if it expects to face a declining marginal tax rate in future years than if it expects to face the same marginal tax rate over time.

Lastly, if the additional layers of ending inventory created by an extra year-end LIFO inventory purchase are not maintained in future years, then “the taxes saved as a result of increasing the inventory level are now merely deferred until the inventory level is reduced...” (Bowen and Pfeiffer 1989, 156). Thus, the tax benefit of purchasing extra LIFO inventory at year-end is greater if a firm's ending inventory level after purchasing these additional units is maintained in future years. For this reason, it is predicted that a LIFO firm will purchase more

extra inventory at year-end, the greater the likelihood that its ending inventory level will be nondecreasing in future years.

II. Empirical Variables,² Hypotheses, and Sample Selection

Year-End Inventory Purchases

A firm's year-end inventory purchasing behavior is represented by the percentage of its annual inventory purchases made in the fourth quarter (PCT).³ The data necessary to compute PCT is obtained by solving the following accounting identity for firm *i* in quarter *t* using quarterly COMPUSTAT data:⁴

$$\text{Purchases}_{i,t} = \text{COGS}_{i,t} + \text{Ending Inventory}_{i,t} - \text{Beginning Inventory}_{i,t} \quad (1)$$

Tax Status

The predictions relating a firm's year-end inventory purchasing strategy to its tax status are tested using the dummy variable TAX.⁵ A firm is classified as low-tax (high-tax) in year *t* if its federal taxes paid before credits imply that its year *t* taxable income is less than (greater than or equal to) that at which the maximum marginal corporate tax rate takes effect.⁶ Low-tax (high-tax) firm-years are coded TAX=1 (TAX=0).

A firm's federal taxes paid before credits are estimated as its federal taxes paid after credits plus the sum of its foreign taxes paid—which approximate its foreign tax credit—and its

² Empirical variables are constructed using as-reported COMPUSTAT numbers. We did not convert these numbers to ex-additional-year-end-inventory-purchases numbers (i.e., to "as-if" numbers) due to the inevitable measurement error that would result. If as-if numbers were used, then some low-tax firms would be reclassified as high-tax firms. Since this reclassification would be more likely the greater a firm's extra year-end inventory purchases, the use of as-reported numbers should be biased against finding support for tax hypothesis H1. Also, the use of as-if numbers would cause a decrease in LTDTA since as-if total assets would increase. Under the reasonable assumption that this decrease in LTDTA would be larger the greater a firm's extra year-end inventory purchases, the use of as-reported numbers should be biased against finding support for debt covenants hypothesis H3. See Shevlin (1987, 503-504) for a more detailed discussion of the use of as-if versus as-reported numbers.

³ If a firm liquidates a LIFO layer in the first three quarters of the year that it expects to replace by year-end, it charges the liquidation quarter's cost of goods sold for the expected cost of replacement. If a firm replaces the liquidated layer in the second or third quarters, there is no effect on PCT. If a firm replaces the liquidated layer in the fourth quarter, PCT understates the percentage of annual inventory purchases actually made in the fourth quarter. This understated PCT would miss the fact that a firm has made an extra inventory purchase to avoid an increase in its taxable income, thus making it more difficult to find support for our hypotheses. If a firm does not replace the liquidated layer, PCT again understates the percentage of annual inventory purchases actually made in the fourth quarter. Since (1) this understated PCT occurs in the year of a LIFO liquidation; and (2) LIFO liquidations are more likely to occur in low-tax years (Tse 1990), a bias is created in favor of finding support for our hypotheses. For this reason, we remove LIFO firm-years in which a LIFO liquidation occurs from our sample.

⁴ Since COMPUSTAT reports only total inventories in its quarterly files, PCT captures only the year-end acceleration of raw materials purchases for periodic LIFO manufacturers. However, in some cases a periodic LIFO manufacturer's COGS can also be increased by the year-end acceleration of the transfer of (1) raw materials to work-in-process (WIP); and/or (2) WIP to finished goods (FG). Numerical examples are available from the authors. Since PCT does not capture any tax-motivated year-end acceleration of the transfer of raw materials to WIP or WIP to FG for periodic LIFO manufacturers, PCT tends to understate the COGS management strategies employed by these firms. This should make it harder to find support for our hypotheses.

⁵ If the cruder tax-status measure "presence or absence of an NOL carryforward" is used, our results are very similar.

⁶ For example, assume a 20 percent tax rate on the first \$100,000 of taxable income and a 46 percent tax rate on taxable income in excess of \$100,000. A firm would be classified as high-tax (low-tax) if its federal taxes paid before credits are greater than or equal to (less than) \$20,000—i.e., .20 x \$100,000. Federal taxes paid before credits are used because the decreased taxable income resulting from extra year-end LIFO inventory purchases reduces a firm's tax burden at its statutory marginal tax rate (Shevlin 1990).

investment tax credit.⁷ This estimate of federal taxes paid before credits can cause an overstatement of inferred taxable income—and a resulting misclassification of some low-tax firm-years as high-tax firm-years—if a firm cannot use all of its tax credits in a given year.⁸ To avoid the inclusion of such misclassified firm-years in the final sample, we omit those observations that are coded as both high-tax using federal taxes paid before credits and low-tax using federal taxes paid after credits.⁹

It is predicted that high-tax LIFO firms are more likely to purchase extra inventory at year-end than low-tax LIFO firms. Since the dummy variable TAX has a high value for low-tax firms, the following alternative hypothesis applies:

- H1: The relation between the dummy variable TAX and the percentage of a LIFO firm's annual inventory purchases made in the fourth quarter (PCT) is negative.

Control Variables

As described in section I, a LIFO firm is expected to purchase more extra inventory at year-end the greater the likelihood that its ending inventory will be nondecreasing in future years.¹⁰ Based on the assumption that the percentage change in a firm's ending inventory from year t to year $t+1$ ($CHGINV = [EI_{t+1} - EI_t]/EI_t$, where EI is ending inventory) is positively associated with the probability that the firm expected—at the end of the year t —to have a nondecreasing ending inventory in the future, the following alternative hypothesis results:

- H2: The relation between the percentage change in a LIFO firm's ending inventory ($CHGINV$) and the percentage of its annual inventory purchases made in the fourth quarter (PCT) is positive.¹¹

The closer a firm is to violating its debt covenants, the more likely it is to take actions that move the financial accounting ratios specified in its debt covenants farther from technical default

⁷ The investment tax credit (ITC) is COMPUSTAT item #51. If firms using the deferral method of accounting for the ITC are removed from the sample (because their book ITC would not equal their tax ITC), our results are virtually identical.

⁸ For example, assume a 30 percent tax rate on the first \$75,000 of taxable income and a 50 percent tax rate on taxable income in excess of \$75,000. That is, a firm would be classified as high-tax if its federal taxes paid before credits are greater than \$22,500. ($.30 \times \$75,000$). Firm X has \$50,000 taxable income, pays \$35,000 in foreign taxes, and thus owes federal taxes before (after) credits of \$15,000 (\$0). Our estimate of federal taxes paid before credits (\$0 + \$35,000) incorrectly classifies low-tax Firm X as high-tax. Such errors are likely to be common. Altshuler and Newlon (1991) find that 53.1 (57.7) percent of U.S. multinational firms were in an excess foreign tax credit position for at least one year from 1982 to 1984 (from 1984 to 1986).

⁹ Thus, for example, misclassified-as-high-tax Firm X described in footnote 8 would be removed from the sample. There were 86 (131) firm-years in the final LIFO (FIFO) sample that were coded as both high-tax using federal taxes paid before credits and low-tax using federal taxes paid after credits. Test results were virtually identical if these firm-years were left in the sample.

¹⁰ This prediction and hypothesis H2 also apply to FIFO firms if they increase year-end inventory levels in anticipation of future sales growth (see footnotes 18 and 28 for a detailed discussion).

¹¹ If firms with older (i.e., lower-cost) LIFO layers are more likely to make extra year-end inventory purchases because the increase in COGS would be relatively more dramatic, then firms with older LIFO layers should exhibit larger PCT. Further, $CHGINV$ (if > 0) will be relatively larger if inventory consists of older LIFO layers. Thus, any observed positive relation between $CHGINV$ and PCT may be driven by the age of LIFO layers. For this reason, to control for the age of a firm's LIFO layers, we reran our tests measuring $CHGINV$ after converting LIFO ending inventories to an as-if constant dollar FIFO basis by (1) adding the LIFO reserve at the end of year t ($t+1$) to LIFO inventory at the end of year t ($t+1$); and then (2) deflating these adjusted ending inventories to a constant dollar basis as described in footnote 28. Our test results were little changed.

levels (e.g., Shevlin 1987). The following matrix shows the effects (in the case of rising prices) of extra year-end inventory purchases on the ratios often specified in a firm's debt covenants:¹²

Type of Firm:	LIFO		FIFO	
Inventory Purchase is for cash or on account:	Cash	Account	Cash	Account
Debt/Assets	Rise	Rise ¹	NC	Rise ¹
Debt/Equity	Rise	Rise	NC	Rise
Interest Expense/Income	Rise	Rise	NC	NC
Working Capital	Fall	Fall	NC	NC
Current Ratio	Fall	Fall ²	NC	Fall ²
Unrestricted Retained Earnings/Dividends	Fall	Fall	NC	NC

¹Assumes the debt ratio is less than one to begin with

²Assumes the current ratio is greater than one to begin with

All of these nonzero changes in ratios would move a firm closer to violating its debt covenants. Thus, it is predicted that the closer a firm is to violating its debt covenants, the less likely it is to purchase extra inventory at year-end.

Press and Weintrop (1990) document that a firm's debt ratio is positively associated with its closeness to violating its debt covenant constraints on working capital, net worth, and leverage. Based on this evidence, the variable used to represent a firm's proximity to violating its debt covenants in year *t* is its long-term debt to total assets ratio (LTDTA) at the end of year *t*.¹³ The relevant alternative hypothesis is:

H3: The relation between a LIFO firm's long-term debt to total assets ratio (LTDTA) and the percentage of its annual inventory purchases made in the fourth quarter (PCT) is negative.

Finally, our measure of year-end inventory purchasing behavior PCT uses data that span an entire quarter. The percentage of a firm's annual inventory purchases made in a given quarter is expected to be in part a function of the percentage of its annual sales made in the same quarter (Bernard and Noel 1991). The related alternative hypothesis is:

¹²Ratio effects are based on the effect of extra year-end inventory purchases on *incremental* taxes, income, assets, debt, and equity. For example, if a periodic LIFO firm makes an extra year-end inventory purchase for \$10 cash that moves a LIFO layer costing \$9 into ending inventory, incremental COGS increase by \$1, cash decreases by \$10, and ending inventory increases by \$9. Thus, relative to no extra year-end purchase, incremental assets, income, and equity decrease by the after-tax incremental increase in COGS (i.e., $\$1 \cdot (1 - \text{tax rate})$ in the simplest case). As an additional example, if a periodic FIFO firm makes an extra year-end inventory purchase for \$10 cash, incremental COGS are unchanged, cash decreases by \$10, and ending inventory increases by \$10. In this case, relative to no extra year-end purchase, incremental assets, income, and equity are unchanged.

¹³The test results reported in tables 3 and 5 were little changed if we used alternate leverage ratios (i.e., long-term debt to equity, total debt to equity, and total debt to assets) to represent a firm's closeness to violating its debt covenants. That is, using these alternate leverage ratios, (1) the estimated coefficients on TAX, CHGINV, and PCTS were virtually identical to those reported in tables 3 and 5; and (2) the significance of the estimated coefficients on the alternate leverage ratios were very similar to those reported for LTDTA in tables 3 and 5.

H4: The relation between the percentage of a firm's annual sales made in the fourth quarter and the percentage of its annual inventory purchases made in the same quarter (PCT) is positive.

Sample Selection

Sample firms were drawn from the COMPUSTAT annual and quarterly Primary/Supplementary/Tertiary Industrial Files. The years of overlapping coverage were 1980 through 1988. COMPUSTAT firms eligible for inclusion in the LIFO sample (the FIFO sample is discussed in section IV) were those that used LIFO as their primary inventory costing method in every year from 1980 to 1988 ($n = 295$ firms).

Since the predictions developed previously only apply if price levels are rising, 278 (10.5 percent) LIFO firm-years in which the annual change in the industry-specific producer price index was negative were removed from the sample.¹⁴ In addition, 330 (13.9 percent) firm-years in which a LIFO inventory liquidation occurred were removed from the remaining sample (see footnote 3).¹⁵ Complete data to calculate the dependent and independent variables existed for 1443 of these surviving firm-years. Table 1 summarizes these LIFO sample selection procedures, while table 2 provides relevant descriptive statistics.

Table 1
Summary of Sample Selection Criteria

	<i>LIFO Firms</i>	<i>FIFO Firms</i>
Firms Using LIFO (FIFO) as their primary inventory costing method in each of the years 1980 through 1988	295	327
Firm-years available for analysis (nine years)	2655	2943
Less: Remaining firm-years in which the change in the two-digit SIC Code producer price index is negative	(278)	(179)
Less: Remaining firm-years in which a LIFO inventory liquidation occurs	(330)	(23) ¹
Less: Remaining firm-years with missing data	(604)	(1172) ²
Firm-Year observations in final sample	1443	1569

¹These liquidations were by primary FIFO-use firms that carried some LIFO inventory.

²This number includes 86 (131) firm-years in the LIFO (FIFO) sample that were coded as both high-tax using federal taxes paid before credits and low-tax using federal taxes paid after credits (see footnote 9).

¹⁴Based on previous arguments, it is predicted that mean PCT of LIFO firm-years in which price levels declined is less than mean PCT of high-tax LIFO firm-years in which price levels increased. Comparing mean PCT of LIFO firm-years removed from the sample because price levels declined to mean PCT of high-tax LIFO firm-years included in the final sample, this prediction receives empirical support at the .02 significance level. We thank an associate editor and an anonymous reviewer for suggesting this test.

¹⁵Firms that liquidated LIFO inventory from 1980 through 1983 were provided by Tom Stober. Firms that liquidated LIFO inventory from 1984 through 1988 were identified by our search of the NAARS data base.

Table 2
Descriptive Statistics for LIFO and FIFO Firm-Years

Panel A: Measures of Central Tendency, Dispersion, and Simple Correlation

Variable	LIFO Firm-Years			FIFO Firm-Years		
	Mean	Std. Dev.	Median	Mean	Std. Dev.	Median
PCT	.255	.032	.255	.256	.040	.255
TAX	.100	.301	0.0	.150	.333	0.0
CHGINV	.098	.278	.070	.081	.270	.046
LTDTA	.156	.111	.146	.178	.153	.149
PCTS	.263	.033	.259	.265	.036	.262
Correlation Matrix						
	CHGINV	LTDTA	PCTS	CHGINV	LTDTA	PCTS
PCT	.074*	-.029	.466*	.143*	-.073*	.510*
CHGINV		.039	.072*		-.047	.187*
LTDTA			.068			-.102*

*significant at .01 level (two-tailed)

Panel B: Distribution of Firm-Year Observations

SIC Industry Code	LIFO: Firm-Years		Firms	FIFO: Firm-Years		Firms
10 (Mining)	—		—	2 (0.1%)		1
13 (Oil & Gas Extraction)	4 (0.3%)		2	7 (0.4%)		3
14 (Nonmetallic Minerals)	8 (0.6%)		1	—		—
16 (Heavy Construction)	—		—	4 (0.3%)		1
20 (Food & Kindred)	43 (3.0%)		8	68 (4.3%)		12
21 (Tobacco)	7 (0.5%)		2	—		—
22 (Textile Mills)	28 (1.9%)		5	43 (2.7%)		8
23 (Apparel)	22 (1.5%)		4	43 (2.7%)		7
24 (Lumber & Wood)	4 (0.3%)		1	17 (1.1%)		4
25 (Furniture)	34 (2.4%)		5	31 (2.0%)		6
26 (Paper Products)	51 (3.5%)		10	26 (1.7%)		4
27 (Printing, Publishing)	66 (4.6%)		10	55 (3.5%)		9
28 (Chemical)	132 (9.1%)		28	118 (7.5%)		21
29 (Petroleum)	36 (2.5%)		16	4 (0.3%)		2
30 (Rubber)	60 (4.1%)		10	14 (0.9%)		5
31 (Leather)	27 (1.9%)		4	8 (0.5%)		1
32 (Stone, Clay, Glass)	62 (4.3%)		10	15 (1.0%)		2
33 (Primary Metal)	54 (3.7%)		16	15 (1.0%)		3
34 (Fabricated Metal)	75 (5.2%)		14	61 (3.9%)		10
35 (Non-elect. Machinery)	132 (9.1%)		28	200 (12.8%)		38
36 (Electrical Machinery)	91 (6.3%)		16	210 (13.4%)		37
37 (Transport. Equip.)	91 (6.3%)		15	85 (5.4%)		13

Continued

Table 2 (Continued)

38 (Instruments)	42 (2.9%)	7	147 (9.4%)	26
39 (Misc. Manufacturing)	31 (2.1%)	5	42 (2.7%)	10
42 (Trucking)	4 (0.3%)	1	8 (0.5%)	2
47 (Transport Svcs.)	—	—	4 (0.3%)	1
49 (EGS Utilities)	4 (0.3%)	2	5 (0.3%)	2
50 (Wholesale Trade)	68 (4.7%)	12	75 (4.8%)	14
51 (Wholesale Trade)	28 (1.9%)	6	28 (1.8%)	8
52 (Hardware, Garden Strs.)	4 (0.3%)	1	4 (0.3%)	1
53 (Gen'l. Merch. Stores)	75 (5.2%)	11	16 (1.0%)	3
54 (Food Stores)	68 (4.7%)	9	18 (1.1%)	3
55 (Auto Dealers)	13 (0.9%)	3	—	—
56 (Apparel Stores)	8 (0.6%)	1	35 (2.2%)	5
58 (Eating Places)	—	—	43 (2.7%)	8
59 (Misc. Retail)	62 (4.3%)	9	24 (1.5%)	5
70 (Hotels)	—	—	3 (0.2%)	1
72 (Personal Services)	—	—	8 (0.5%)	1
73 (Business Services)	1 (0.1%)	1	40 (2.5%)	9
75 (Auto Repair)	8 (0.6%)	1	—	—
78 (Motion Pictures)	—	—	12 (0.8%)	2
79 (Amusement)	—	—	17 (1.1%)	3
80 (Medical Services)	—	—	2 (0.1%)	1
82 (Education Services)	—	—	4 (0.3%)	1
87 (Other Svcs.)	—	—	8 (0.5%)	3
TOTAL	1443	274	1569	296

Variable Definitions

The variables reported in table 2 are defined as follows:

PCT: Percentage of a firm's annual inventory purchases made in the fourth quarter of year t ($t=1980, \dots, 1988$ for all variables).

TAX: If a firm's federal taxes paid before credits in year t imply that its year t taxable income is less than (greater than or equal to) that at which the maximum marginal corporate tax rate takes effect, then the dummy variable TAX=1 (TAX=0).

CHGINV: A firm's ending inventory at the end of year $t+1$ minus its ending inventory at the end of year t , divided by the firm's ending inventory at the end of year t .

LTDTA: A firm's long-term debt divided by total assets ratio at the end of year t .

PCTS: Percentage of a firm's annual sales made in the fourth quarter of year t .

Sample firms are firms that used LIFO (FIFO) as their primary inventory costing method in each of the years 1980 through 1988.

III. Test Results for LIFO Firms

Regression Tests

The following regression model is estimated for LIFO firms (with firm-year subscripts, annual dummy variables and dummy variables for each firm suppressed):

$$PCT = \alpha_0 + \alpha_1 TAX + \beta_1 CHGINV + \beta_2 LTDTA + \beta_3 PCTS + e \quad (2)$$

where

PCT: Percentage of a firm's annual inventory purchases made in the fourth quarter of year t ($t = 1980, \dots, 1988$ for all variables).

TAX: If a firm's federal taxes paid before credits in year t imply that its year t taxable income is less than (greater than or equal to) that at which the maximum marginal corporate tax rate takes effect, then the dummy variable $TAX = 1$ ($TAX = 0$). Predicted sign: negative.

CHGINV: Percentage change in a firm's ending inventory from year t to year $t+1$. Predicted sign: positive.

LTDTA: A firm's long-term debt to total assets ratio at the end of year t . Predicted sign: negative.

PCTS: Percentage of a firm's annual sales made in the fourth quarter of year t . Predicted sign: positive.

The model in equation (2) is augmented with dummy variables that allow for shifts in the intercept term both across individual firms and over time. That is, equation (2) is estimated using the covariance (i.e., fixed effects) model. These dummy variables are meant to capture the effects of firm-specific and time-specific variables not explicitly included in our model.

The covariance model estimate of equation (2) for LIFO firms is reported in the first column of table 3. LIFO firms inferred to be paying taxes at the maximum marginal rate are estimated to make .6 percent more of their annual inventory purchases in the fourth quarter than LIFO firms inferred to be paying taxes at less than the maximum marginal rate (this difference is significant at the .004 level).¹⁶ This is consistent with the prediction that high-tax LIFO firms are more likely to purchase extra inventory at year-end than low-tax LIFO firms.¹⁷

The economic significance of the .006 estimated coefficient on TAX is judged to be substantial as follows. When converted to a dollar amount using mean annual inventory purchases, this estimated difference in the percentage of annual inventory purchases made in the fourth quarter between high-tax and low-tax LIFO firms (i.e., .6 percent) is equivalent to \$12.66 million of purchases (3.8 percent of mean ending inventory). In addition, if it is assumed that LIFO inventory purchased at the end of a year costs 15 percent more than the inventory layers it replaces in cost of goods sold, these \$12.66 million of purchases convert to a cost of goods sold increase of \$1.90 million. This is equivalent to a 1.9 percent decrease in mean pretax income.

The estimated coefficient on the change in inventory variable CHGINV is positive at the .025 significance level. This is consistent with the prediction that a LIFO firm purchases more extra

¹⁶ Unless otherwise stated, one-tailed significance levels are reported.

¹⁷ Also, the mean percentage of annual inventory purchases made in the fourth quarter by high-tax (by low-tax) LIFO firms is 25.7 percent (24.6 percent) (difference significant at the .004 level).

inventory at year-end, the greater the likelihood that its ending inventory will be nondecreasing in future years.¹⁸

The estimated coefficient on the debt covenants variable LTDTA has the predicted negative sign, but it is not significant at the .10 level. Thus, little support is found for the hypothesis that the closer a LIFO firm is to violating its debt covenants, the less likely it is to purchase extra inventory at year-end. Lastly, as predicted, the percentage of a LIFO firm's annual inventory purchases made in the fourth quarter is positively associated with the percentage of its annual sales made in the same quarter (.001 significance level).

A criticism of the covariance model is that it does not identify the factors that cause the regression line to shift across firms and over time. The error components model is often suggested as an alternative to the covariance model.¹⁹ Estimates of equation (2) for LIFO firms using an error components model and a mixed error components moving average model that allows for serially correlated disturbances are reported in the second and third columns of table 3.²⁰ The most notable difference in the results is that the estimated negative coefficient on the debt covenants variable LTDTA is now significant at the .02 level. This offers stronger support than before for the prediction that a LIFO firm is less likely to purchase extra inventory at year-end, the closer it is to violating its debt covenants.²¹

Other LIFO Tests

If high-tax LIFO firms purchase extra inventory at year-end and low-tax LIFO firms do not, then the change in the percentage of annual inventory purchases made in the fourth quarter from year t to year $t+1$ (PCT_{t+1} minus PCT_t) should be (1) negative for LIFO firms that are high-tax in year t and low-tax in year $t+1$; (2) positive for LIFO firms that are low-tax in year t and high-tax in year $t+1$; (3) insignificantly different from zero for LIFO firms that are high-tax in both year t and year $t+1$; and (4) insignificantly different from zero for LIFO firms that are low-tax in both year t and year $t+1$. To test these predictions, we calculated mean PCT_{t+1} minus PCT_t for each of these four groups of firm-years. The results are reported in table 4.

As predicted, LIFO firms that move from a high-tax status in year t to a low-tax status in year $t+1$ decrease the percentage of their annual inventory purchases made in the fourth quarter from

¹⁸ The simple correlation between CHGINV and the percentage change in a firm's sales from year t to year $t+1$ (CHGSLS) is .64. Thus, the positive association between CHGINV and PCT is also consistent with firms increasing year-end inventory levels in anticipation of future sales growth. In fact, if we estimate equation (2) using CHGSLS in place of CHGINV, the estimated coefficient on CHGSLS is positive at the .01 significance level. We thank an anonymous referee for suggesting this test.

¹⁹ While the covariance model assumes separate firm-specific and annual intercepts, the error components model assumes that these firm-specific and annual intercepts are two distinct normally distributed random variables. This assumption allows degrees of freedom to be saved in the estimation of equation (2) relative to the covariance model. Another advantage of the error components model is that it permits statistical inference beyond the specific sample studied. Statistical inference in the covariance model applies only to the sample observations. The primary drawbacks to the error components model are: (1) assumptions about the distribution of the intercepts that are not necessary in the covariance model are required in the error components model; and (2) the error components model may be less efficient than the covariance model if the number of sample firms or the number of sample years is small. See Dielman (1989, chapter 4) for a more detailed comparison of the covariance and error components models.

²⁰ We used the FULLER and DASILVA options of the SAS TSCSREG procedure. These options require that no missing data exist. Therefore, if a variable (e.g., LTDTA) had a missing value in a given year, we set that missing value equal to the mean of the relevant variable.

²¹ However, the following caveat is in order. Relative to the covariance model estimate of equation (2), LTDTA standard errors are notably smaller in the error components models estimates of equation (2). If this is due to the missing value procedure described in footnote 20, then this procedure could partially explain the increased significance of the estimated coefficient on LTDTA in the error components models estimates of equation (2). We thank an associate editor for pointing this out.

Table 3
LIFO Regression Estimates of the Model:¹

$$PCT = \alpha_0 + \alpha_1 TAX + \beta_1 CHGINV + \beta_2 LTDTA + \beta_3 PCTS + e$$

	<i>Predicted Sign</i>	<i>Covariance Model</i>	<i>Error Components Models:²</i>	
			<i>Fuller-Battese</i>	<i>DaSilva</i>
intercept (α_0)		.030	.105	.106
t-statistic		3.28 (.001) ³	19.24 (.000)	19.08 (.001)
TAX (α_1)	—	-.006	-.004	-.004
t-statistic		-2.63 (.004)	-1.74 (.041)	-1.70 (.045)
CHGINV (β_1)	+	.004	.004	.004
t-statistic		1.96 (.025)	2.33 (.010)	2.27 (.012)
LTDTA (β_2)	—	-.007	-.013	-.013
t-statistic		-.76 (.224)	-2.05 (.020)	-2.08 (.019)
PCTS (β_3)	+	.827	.575	.570
t-statistic		27.73 (.001)	29.22 (.001)	28.80 (.001)
Adjusted R-square		.638	.502	.522

¹ All variables in the model are defined in table 2.

² The Fuller-Battese method estimates the error components model. The DaSilva model is a mixed error components moving average model that allows for serially correlated disturbances. The SAS procedure TSCSREG is used to operationalize the models.

³ One-tailed p-value reported in parentheses.

Sample firms are firms that used LIFO as their primary inventory costing method in each of the years 1980 through 1988.

year t to year $t+1$ (.048 (.016) significance level using a t-test (a sign-rank test)).²² Also as predicted, LIFO firms that move from a low-tax status in year t to a high-tax status in year $t+1$ increase the percentage of their annual inventory purchases made in the fourth quarter from year t to year $t+1$ (.008 (.013) significance level using a t-test (a sign-rank test)).²³

Moreover, the change in the percentage of a firm's annual inventory purchases made in the fourth quarter from year t to year $t+1$ is not significantly different from zero at the .20 level for LIFO firms that have either a high-tax status or a low-tax status in both year t and year $t+1$. This is expected, since these firms would be following the same year-end inventory acquisition strategy in both year t and year $t+1$.²⁴

²² The economic significance of this result is measured as before. Mean PCT_{t+1} minus PCT_t converts to \$28.89 million of inventory purchases (12.1 percent of mean ending inventory) and a cost of goods sold increase of \$3.74 million (a 4.2 percent decrease in mean pretax income).

²³ If LIFO firms increase year-end inventory levels in anticipation of future sales growth (see footnote 18), then mean PCT_{t+1} minus PCT_t should be negative (positive) for LIFO firms that have both an increase (a decrease) in sales from year t to year $t+1$ and a decrease (an increase) in sales from year $t+1$ to year $t+2$. These predictions are supported at the .01 level. However, (1) the Spearman correlation coefficient between TAX_t and change in sales from year t to year $t+1$ is only -.052; and (2) for FIFO firms, all four mean PCT_{t+1} minus PCT_t are insignificantly different from zero using tax status in year t and year $t+1$ to partition firms, while mean PCT_{t+1} minus PCT_t is negative (positive) at the .01 significance level if sales both increase (decrease) from year t to year $t+1$ and decrease (increase) from year $t+1$ to year $t+2$. Thus, we conclude that the results reported in table 4 are caused by tax factors rather than the growth/decline of LIFO firms' sales.

²⁴ The results reported in this subsection were confirmed using an ANOVA analysis comparing declining, increasing, and constant tax-rate firm-years. The results of this analysis were: (average PCT_{t+1} minus PCT_t of increasing tax-rate firm-years) > (average PCT_{t+1} minus PCT_t of constant tax-rate firm-years) > (average PCT_{t+1} minus PCT_t of declining tax-rate firm-years) at the .05 significance level.

Table 4
Tests of Fourth Quarter LIFO Inventory Purchases Conditioned on Firms'
Time-Series Patterns of Tax-Status Realizations

<i>Panel A: Predicted Relations</i>				
<i>Firm's Tax Status in year t</i>	<i>Firm's Tax Status in year t+1</i>	<i>Predicted PCT in year t</i>	<i>Predicted PCT in year t+1</i>	<i>Predicted PCT_{t+1} minus PCT_t</i>
LOW	HIGH	LOW	HIGH	MOST POSITIVE
LOW	LOW	LOW	LOW	INDETERMINATE
HIGH	HIGH	HIGH	HIGH	INDETERMINATE
HIGH	LOW	HIGH	LOW	MOST NEGATIVE

<i>Panel B: Empirical Results</i>				
<i>Firm's Tax Status in year t</i>	<i>Firm's Tax Status in year t+1</i>	<i>Observed Mean (PCT_{t+1} minus PCT_t)</i>	<i>Significance Levels for (PCT_{t+1} minus PCT_t)</i>	
			<i>t-test</i>	<i>Sign-rank test²</i>
LOW	HIGH	.017	.008	.013
LOW	LOW	.003	.286	.490
HIGH	HIGH	-.0007	.260	.410
HIGH	LOW	-.020	.048	.016

¹PCT is the percentage of a firm's annual inventory purchases made in the fourth quarter of year t (t=1980,..., 1988). A firm is classified as low-tax (high-tax) in year t if its federal taxes paid before credits in year t imply that its year t taxable income is less than (greater than or equal to) that at which the maximum marginal corporate tax rate takes effect.

² $PCT_{t+1} - PCT_t$ is first calculated for each relevant sample observation. Next, (1) a t-test is used to test the alternative hypothesis that the magnitude of mean $PCT_{t+1} - PCT_t$ is significantly different from zero in the predicted direction; and (2) the absolute differences $|PCT_{t+1} - PCT_t|$ are ranked, the ranks of positive and negative $PCT_{t+1} - PCT_t$ are summed, and the Wilcoxon sign-rank test is used to test whether the sum of the ranks is in the predicted direction.

Sample firms are firms that used LIFO as their primary inventory costing method in each of the years 1980 through 1988.

IV. Further Results

In this section, we first report the results of tests which exploit the reduction in tax rates mandated by the Tax Reform Act of 1986 to examine the prediction that, relative to other years, a LIFO firm makes more extra year-end inventory purchases in years preceding a decline in its tax rate. Next, we report the results of tests of the predictions that (1) there is no systematic relation between a FIFO firm's tax status and its percentage of annual inventory purchases made in the fourth quarter; and (2) LIFO firms are more likely to purchase extra inventory at year-end than FIFO firms.

Effect of the Tax Reform Act of 1986

The Tax Reform Act of 1986 reduced the maximum marginal corporate tax rate from 46 percent to 34 percent. This reduction in rates was phased in over a firm's 1987 and 1988 taxable

years.²⁵ As a result, a firm paying taxes at the maximum marginal rate would experience a declining tax rate from 1986 to 1987 and from 1987 to 1988.

As discussed in section I, a LIFO firm is predicted to purchase more extra inventory at year-end if it expects to face a declining marginal tax rate in future years than if it expects to face the same marginal tax rate over time. Since the maximum marginal corporate tax rate remained the same from 1980 through 1986 before dropping in both 1987 and 1988, the percentage of annual inventory purchases made in the fourth quarter of year t by a LIFO firm paying taxes at the maximum marginal rate in both year t and year $t+1$ ($t=1980, \dots, 1987$) should be greater in both 1986 and 1987 than from 1980 through 1985.

This prediction is tested as follows. First, LIFO firm-years that are high-tax in both year t and year $t+1$ are identified. For each firm in this sample, the mean of the percentage of its annual inventory purchases made in the fourth quarter from 1980 through 1985 (PCT_{8085}) is calculated. Next, two difference variables, equal to PCT_{1986} minus PCT_{8085} and PCT_{1987} minus PCT_{8085} , are computed for each firm. As predicted, the means of PCT_{1986} minus PCT_{8085} (1.3 percent) and PCT_{1987} minus PCT_{8085} (1.2 percent) are both greater than zero (.000 significance level).²⁶

Additional evidence confirming this result is offered by the estimated coefficients on the annual dummy variables for the years 1986 and 1987 in the covariance model estimate of equation (2). Specifically, the estimated coefficients on the dummy variables for these years, which test for a shift in PCT by LIFO firms preceding the reduction in tax rates mandated by the Tax Reform Act of 1986, are both positive at the .01 significance level.

Tests Using FIFO Observations

Tests using FIFO firm-years only. Since FIFO firms show the same cost of goods sold regardless of their year-end inventory procurement decisions (Halperin 1981), there are no tax benefits to a FIFO firm from purchasing extra inventory at year-end. Thus, there should be no particular relation between the percentage of a FIFO firm's annual inventory purchases made in the fourth quarter (PCT) and its tax status. To test this hypothesis, a FIFO sample was formed using the same criteria as before. This FIFO sample selection process is summarized in table 1, while relevant descriptive statistics are provided in table 2.

Panel B of table 2 indicates that FIFO firm-years have a different distribution across industries than LIFO firm-years. More importantly, FIFO firms are likely to differ from LIFO firms along many production, investment, and financing dimensions that are not represented by our test variables.²⁷ Therefore, any inferences drawn from our FIFO results should be interpreted with this caution in mind.

In table 5, we report the estimates of equation (2) using FIFO firm-years.²⁸ The estimated

²⁵Specifically, on the first day of a firm's fiscal year following June 30, 1986, its maximum marginal tax rate was reduced by one percent times the number of months that its fiscal year-end followed June 30, 1986. In the following fiscal year, the firm's maximum marginal tax rate was reduced to 34 percent.

²⁶If the sample is restricted to calendar-year firms in order to synchronize (1) the response of firms to the Tax Reform Act of 1986; and (2) the size of the 1986 and 1987 reduction in maximum marginal tax rates, very similar results are obtained.

²⁷For example, Dopuch and Pincus (1988,45) find that even after converting financial data to an as-if-LIFO or as-if-FIFO basis, firm size, holding gains, capital intensity, and mean inventory price changes are significantly greater for LIFO firms. Moreover, for the data reported in Panel A of table 2, the variables that differ at the .05 significance level (two-tailed) between LIFO and FIFO firms are PCTS, TAX, and LTDTA. We thank Wayne Shaw for drawing our attention to this.

²⁸In estimating FIFO equation (2), ending FIFO inventory levels were deflated by a firm's two-digit SIC producer price index when calculating CHGINV because FIFO ending inventory consists of recently acquired layers. We observe that the estimated coefficient on CHGINV is positive at the .10 significance level in the error components models estimates of FIFO equation (2). This result is consistent with the explanation that firms increase year-end inventory levels in anticipation of future sales growth (see footnote 18).

Table 5
FIFO Regression Estimates of the Model:¹

$$PCT = \alpha_0 + \alpha_1 TAX + \beta_1 CHGINV + \beta_2 LTDTA + \beta_3 PCTS + e$$

<i>Predicted Sign</i>		<i>Covariance Model</i>	<i>Error Components Models:²</i>	
			<i>Fuller-Battese</i>	<i>DaSilva</i>
Intercept (α_0)		.057	.123	.123
t-statistic		5.22 (.001) ³	22.45 (.001)	22.36 (.001)
TAX (α_1)	insig.	-.001	.000	-.000
t-statistic		-.52 (.301)	.02 (.500)	-.01 (.495)
CHGINV (β_1)	insig. ⁴	.001	.002	.002
t-statistic		.53 (.300)	1.70 (.044)	1.62 (.053)
LTDTA (β_2)	insig.	-.008	-.003	-.003
t-statistic		-.97 (.165)	-.76 (.223)	-.69 (.245)
PCTS (β_3)	+	.775	.510	.509
t-statistic		25.93 (.001)	26.13 (.001)	26.03 (.001)
Adjusted R-square		.535	.378	.387

¹ All variables in the model are defined in table 2.

² The Fuller-Battese method estimates the error components model. The DaSilva model is a mixed error components moving average model that allows for serially correlated disturbances. The SAS procedure TSCSREG is used to operationalize the models.

³ One-tailed p-value reported in parentheses.

⁴ Or positive (see footnote 18).

Sample firms are firms that used FIFO as their primary inventory costing method in each of the years 1980 through 1988.

coefficient on the tax-status dummy variable TAX is not significant at the .30 level.²⁹ This result supports the prediction that, for FIFO firms, tax status is not related to the percentage of annual inventory purchases made in the fourth quarter.

Tests comparing LIFO and FIFO firm-years. As described previously, LIFO and FIFO firms are likely to differ along many dimensions that are not captured by our test variables. Therefore, it is prudent to try to control for these differences before comparing the percentage of annual inventory purchases made in the fourth quarter by LIFO and FIFO firms.³⁰

For this reason, we first matched high-tax LIFO and high-tax FIFO firm-years by two-digit SIC to control for industry effects. Next, within any two-digit SIC that had at least ten high-tax LIFO and ten high-tax FIFO firm-years, we compared the mean PCT minus PCTS (percentage of annual inventory purchases made in the fourth quarter minus percentage of annual sales made

²⁹ Also, if the tests reported in table 4 are repeated using FIFO firm-years, mean $PCT_{i,t-1}$ minus PCT_i is not significantly different from zero at the .10 level for any of the four partitions of FIFO firm-years.

³⁰ Nevertheless, if LIFO and FIFO firm-years are pooled and equation (2) is augmented with intercept dummy variables for high-tax LIFO, low-tax LIFO, high-tax FIFO, and low-tax FIFO firm-years, it is observed that high-tax LIFO firms make a greater percentage of their annual inventory purchases in the fourth quarter than low-tax LIFO firms (.01 significance level), while the difference in fourth quarter inventory purchasing behavior between high-tax and low-tax FIFO firms is not significant at the .30 level.

Table 6
A Comparison of the Fourth Quarter Inventory
Purchases of LIFO Firms and FIFO Firms

<i>Two-Digit SIC Industry Code (Industry Name)</i>	<i>Mean PCT-PCTS¹ (no. of firms):</i>		<i>t-test of difference²</i>	<i>One-Tailed p-value³</i>
	<i>LIFO firms</i>	<i>FIFO firms</i>		
20 (Food & Kindred)	-.007 (40)	-.010 (54)	.44	.330
22 (Textile Mills)	-.011 (25)	-.014 (13)	.31	.380
23 (Apparel)	-.024 (20)	.001 (32)	-1.80	.961
25 (Furniture)	-.002 (34)	-.005 (21)	.55	.291
26 (Paper Products)	-.003 (49)	.001 (25)	-1.35	.909
27 (Printing, Publishing)	.002 (65)	-.010 (48)	2.84	.002
28 (Chemical)	.001 (125)	-.010 (114)	2.55	.005
30 (Rubber)	.006 (60)	-.006 (13)	1.81	.037
32 (Stone, Clay, Glass)	.003 (50)	-.004 (10)	1.30	.099
34 (Fabricated Metal)	-.000 (69)	-.016 (34)	2.73	.004
35 (Non-elect. Machinery)	-.004 (98)	-.014 (149)	2.15	.017
36 (Electrical Machinery)	-.000 (87)	-.005 (140)	1.24	.108
37 (Transport. Equip.)	-.000 (79)	-.007 (68)	1.67	.048
38 (Instruments)	-.015 (36)	-.006 (105)	-1.60	.944
39 (Misc. Manufacturing)	-.044 (29)	-.038 (32)	-.39	.652
50 (Wholesale Trade)	.004 (53)	-.014 (57)	3.28	.001
51 (Wholesale Trade)	-.001 (23)	-.006 (21)	1.21	.117
53 (Gen'l. Merch. Stores)	-.078 (73)	-.040 (14)	-2.63	.995
54 (Food Stores)	-.003 (68)	-.006 (14)	.92	.180
59 (Misc. Retail)	-.026 (59)	-.018 (16)	-.54	.704

¹ PCT is the percentage of a firm's annual inventory purchases made in the fourth quarter of year t ($t = 1980, \dots, 1988$). PCTS is the percentage of a firm's annual sales made in the fourth quarter of year t .

² The difference tested is (mean PCT minus PCTS of LIFO firms) minus (mean PCT minus PCTS of FIFO firms). This column reports the t -statistic associated with the alternative hypothesis that this difference is greater than zero.

³ This column reports the one-tailed p -value associated with the t -statistic reported in column 4.

Sample firms are firms that used LIFO (FIFO) as their primary inventory costing method in each of the years 1980 through 1988.

in the same quarter) of high-tax LIFO firm-years to the mean PCT minus PCTS of high-tax FIFO firm-years³¹ to test the following alternative hypothesis:

H5: Within a two-digit SIC, relative to high-tax FIFO firm-years, high-tax LIFO firm-years have a greater percentage of annual inventory purchases made in the fourth quarter minus percentage of annual sales made in the same quarter (i.e., a greater PCT minus PCTS).

The motivation for this hypothesis is that high-tax LIFO firms have a tax incentive to purchase extra inventory at year-end that high-tax FIFO firms do not.

³¹ High-tax firm-years were used because high-tax LIFO firms are more likely to purchase extra inventory at year-end—both theoretically and empirically—than other firms. We used a PCT minus PCTS variable in our tests to control for the percentage of annual sales made in the fourth quarter. Similar test results were obtained by (1) comparing high-tax LIFO firm-years to all FIFO firm-years; and (2) using the PCT (rather than PCT minus PCTS) variable.

The results of these tests are reported in table 6. There were twenty SICs that had at least ten high-tax LIFO and ten high-tax FIFO firm-years. The difference in the mean PCT minus PCTS between high-tax LIFO and high-tax FIFO firm-years is significant at the .05 level in the predicted direction (in the “wrong” direction) for seven (for two) of these 20 SICs.³² Since this test generally supports the prediction that high-tax LIFO firms are more likely to purchase extra inventory at year-end than matched high-tax FIFO firms, confidence in our tax-motivated interpretation of the results for LIFO firms is increased.

V. Conclusion

By examining the percentage of firms’ annual inventory purchases made in the fourth quarter, this study finds empirical evidence consistent with the predictions of prior analytical models (Cohen and Halperin 1980; Halperin 1979, 1981; Biddle and Martin 1985) that (1) high-tax LIFO firms are more likely to purchase extra inventory at year-end than low-tax LIFO firms; (2) LIFO firms are more likely to purchase extra inventory at year-end than FIFO firms; (3) no difference in year-end inventory purchasing behavior exists for FIFO firms as a function of their tax status; and (4) a LIFO firm purchases more extra inventory at year-end if it faces a declining marginal tax rate in future years than if it faces the same marginal tax rate over time.

The finding that additional year-end LIFO inventory purchases appear to be made for tax reasons suggests that permitting the LIFO method to be used for tax purposes leads to inventory management inefficiencies. Given the large dollar amounts of tax-motivated inventory purchases implied by our results (see, e.g., footnote 22), the potential economic impact of these inventory management inefficiencies would seem to be substantial.

References

- Altshuler, R., and T. S. Newlon. 1991. The effects of U.S. tax policy on the income repatriation patterns of U.S. multinational corporations. Working paper, Columbia University, New York, NY.
- Bernard, V., and J. Noel. 1991. Do inventory disclosures predict sales and earnings? *Journal of Accounting, Auditing and Finance* 6 (Spring): 145-181.
- Biddle, G. C., and R. K. Martin. 1985. Inflation, taxes, and optimal inventory policy. *Journal of Accounting Research* 23 (Spring): 57-83.
- Bowen, R. M., and G. M. Pfeiffer. 1989. The year-end LIFO purchase decision: The case of Farmer Brothers Coffee. *The Accounting Review* 64 (January): 152-171.
- Cohen, M., and R. Halperin. 1980. Optimal inventory order policy for a firm using the LIFO inventory costing method. *Journal of Accounting Research* 18 (Autumn): 375-389.
- Dielman, T. 1989. *Pooled Cross-sectional and Time Series Data Analysis*. New York, NY: Marcel Dekker, Inc.
- Dopuch, N., and M. Pincus. 1988. Evidence on the choice of inventory accounting methods: LIFO versus FIFO. *Journal of Accounting Research* 26 (Spring): 28-59.
- Halperin, R. 1979. The effects of LIFO inventory costing on resource allocation: A public policy perspective. *The Accounting Review* 54 (January): 58-71.
- . 1981. The effects of LIFO inventory costing on resource allocation: A reply. *The Accounting Review* 56 (October): 977-979.
- Jannis, C., C. Poedtker, and D. Ziegler. 1980. *Managing and Accounting for Inventories*. New York, NY: John Wiley & Sons.

³² Also, 14 of these 20 differences are positive (.058 significance level using a sign test that assumes independence across industries).

- Press, E., and J. Weintrop. 1990. Accounting-based constraints in public and private debt agreements: Their association with leverage and impact on accounting choice. *Journal of Accounting and Economics* 12 (January): 65-95.
- Shevlin, T. 1987. Taxes and off-balance-sheet financing: Research and development limited partnerships. *The Accounting Review* 62 (July): 480-509.
- . 1990. Estimating corporate marginal tax rates with asymmetric tax treatment of gains and losses. *The Journal of the American Taxation Association* 12 (Spring): 51-67.
- Stober, T. 1986. The incremental information content of financial statement disclosures: The case of LIFO inventory liquidations. *Journal of Accounting Research* 24 (Supplement): 138-160.
- Tse, S. 1990. LIFO liquidations. *Journal of Accounting Research* 28 (Spring): 229-238.

Further Evidence on the Determinants of Municipal Audit Fees

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SYNOPSIS AND INTRODUCTION: In this study, we extend existing municipal audit fee models (e.g., Rubin 1988; Baber et al. 1987) by incorporating additional variables that reflect unique aspects of the municipal accounting and auditing environment. These variables relate to auditor expertise, audit adjustments, audit qualifications, and measures of agency costs related to the level of taxpayer funding of services. We test our model on a sample of Michigan municipalities and find that the fee model explains a greater portion of the variation in audit fees than previous studies.

Palmrose (1986) did not find a significant relationship between audit fees for private sector companies and measures of auditor industry experience. In a study of auditors of Texas school districts, Deis and Giroux (1992a) find that audit quality is positively associated with the number of school districts audited by the audit firm. In our study, the regional audit firm with the largest number of municipal clients received significantly higher fees. This result is consistent with the existence of a fee premium due to brand-name reputation based on industry experience. Previous research has not documented reputation effects for non-Big 6 firms.

We also find that audit fees are positively associated with the number of audit adjustments. Many of the governmental entities in our sample have significantly more audit adjustments than entities in the private sector (Kreutzfeldt and Wallace 1986; Hylas and Ashton 1982), suggesting that there is opportunity for improvement

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in many municipal accounting and control systems. The frequency and nature of audit adjustments in the public sector may be an area of future research interest.

Previous studies of municipal audit fees (Baber et al. 1987; Rubin 1988; Copley 1989) have not found a significant relationship between audit qualifications and audit fees. We separate audit qualifications into two types of qualifications expected to have different relationships to audit fees. However, neither qualification variable is found to be significantly related to audit fees. The frequent nature of opinion qualifications in the municipal sector suggests that these qualifications may not involve significant amounts of additional audit effort.

We find some evidence that audit fees are positively related to agency variables which measure the extent of taxpayer funding of services (Copley 1991; Deis and Giroux 1992b). These variables may capture elected officials' incentives to demonstrate accountability to taxpayers. We do not find a relationship between audit fees and measures of agency costs related to the form of government. We also do not find a relationship between audit fees and measures of political competition. Future research should consider a broader set of incentives for monitoring in the public sector, including agency costs which measure taxpayer funding of services.

Key Words: *Municipal auditing, Audit fees, Monitoring, Public sector.*

Data Availability: *The data used in this study are available upon request from the authors.*

THE remainder of the paper is organized as follows. The model of municipal audit fees is developed in the next section. Section II describes the sample and data collection procedures. Section III is a discussion of the results. Section IV contains our conclusions and suggestions for future research.

I. Model of Municipal Audit Fees

We develop our audit fee model based on the fee model in Rubin (1988).¹ We expand Rubin's model to test additional factors which previous research indicates may be important in the municipal environment, including auditor expertise, audit adjustments, and audit qualifications. Previous research suggests that the demand for auditing is related to agency costs (Zimmerman 1977) and political competition (Baber et al. 1987), so these factors are also included in the fee model.

Significant variables from Rubin's model incorporated as control variables in this study include the log of debt per capita, bond rating, form of the financial report, performance of the audit during the "busy season," whether the audit was awarded by competitive bid, audit firm membership in the Big 6, and auditor and finance officer tenure.² Copley (1989) suggests that revenue is a better proxy for size across forms of government, so we use revenues rather than

¹Copley (1989) extends Rubin's study to a broader sample that includes both cities and counties and obtains results that are generally consistent with Rubin's.

²Because the municipalities in our sample are smaller on average than those found in Rubin (1988), bond ratings are only available for approximately half of our sample. Consistent with Rubin's study, we use a dichotomous indicator variable distinguishing investment and non-investment grade bonds. Entities for which a bond rating is not available are classified as non-investment grade if debt per capita is greater than the sample mean.

population. We use the number of significant funds as a proxy for the number of municipal services variable in Rubin's model.³ An indicator variable of whether the auditor's opinion is at the combined level (encompassing totals for each fund-type) or combining level (encompassing each individual fund) is included as an additional measure of report complexity.⁴

Added Explanatory Variables

Auditor experience. In a study of audit quality for Texas school districts, Deis and Giroux (1992a) find that audit quality is positively related to the industry experience of the audit firm. When audit quality is defined as membership in the Big 6, several studies of private sector audit fees (e.g., Palmrose 1986; Francis and Simon 1987) have found that audit quality is associated with a fee premium. If industry experience is a dimension of audit quality, we expect it to be associated with a fee premium.

One regional audit firm audited a significant portion (21 percent) of the municipalities in the study. No other firm audited more than five percent of the sample. We include an indicator variable to test whether this firm receives a significant fee premium.

Number of adjusting entries. A potentially important aspect of the auditor's cost function that has not been addressed in previous audit fee research is the number of journal entries proposed by the auditor. We expect a large number of audit adjustments for the governmental units in our sample because in governmental accounting, each fund type is a separate reporting entity. Also, errors in one fund often affect another fund, resulting in multiple adjustments due to one error. Municipal accounting is also more complex because different fund types have different bases of accounting.

As part of a survey sent to sample municipalities, we requested information on the number of audit adjustments. The number of audit adjustments was categorized in increments of ten adjustments to reduce the sensitivity of this item to survey respondents. The mean number of audit adjustments in the sample was 34.⁵ It is likely that at least a portion of these adjustments represent normal year-end accruals that could be characterized as accounting services. However, we expect that the cost of such adjustments would be incorporated in the audit fee.

Qualified opinions. Previous studies of municipal audit fees have not found a significant relation between audit fees and opinion qualifications (Baber et al. 1987; Rubin 1988; Copley 1989).⁶ In contrast, studies of audit fees in the private sector (Simunic 1980; Palmrose 1986) have found opinion qualifications to be significantly related to audit fees. Opinion qualifications are more common in the governmental sector, particularly for General Fixed Assets.⁷

³ We use the number of significant funds because it is a direct measure of entity complexity. We define a significant fund as one that represents more than 10% of revenues for that fund type. This measure was collected directly from the municipality's financial statements.

⁴ In governmental audits, the auditor's opinion usually encompasses the combined financial statements, which only includes totals for each fund type. This is similar to auditing a consolidated entity. When the audit report is on the combining level, the auditor's opinion extends to the individual funds that make up the fund totals. When the auditor reports on the combining basis, materiality should decrease, increasing audit costs.

⁵ The number of audit adjustments is considerably greater than found in studies of audit adjustments in the commercial sector. Studies by Kreutzfeldt and Wallace (1986) and Hylas and Ashton (1982) report average audit adjustments of 5.75 and 1.85, respectively.

⁶ Roberts and Glezen (1990) and Deis and Giroux (1992b) found a positive relation between audit fees and opinion qualifications for Texas school districts. In each of these studies, the number of school districts with a qualified opinion was less than five percent of the total sample.

⁷ For example, 28 percent of the cities in Rubin (1988) received qualified opinions. In contrast, eight percent of the companies in Palmrose (1986) received qualified opinions. For the municipalities in our study, 29 percent received one or more qualifications. Of these municipalities, 19 percent received fixed asset qualifications, and 15 percent received other qualifications.

Audit qualifications may differ in their effect on audit fees. Many governmental qualifications involve a failure to record fixed assets. If the client lacks adequate fixed asset records, the auditor may spend less audit time and qualify the audit opinion with respect to these fixed assets. Other report qualifications that do not involve a lack of records are more likely to be associated with increased audit effort. Accordingly, we expect general fixed assets qualifications to be associated with lower audit fees, and other qualifications to be associated with higher audit fees.

Agency and Political Costs

Agency costs. Copley (1991) suggests that the level of monitoring increases with the extent of taxpayer funding of services. Municipal officials agree to additional monitoring to demonstrate to voters that they are fiscally responsible with voter supplied resources. Deis and Giroux (1992b) found that audit fees decrease with the percentage of revenues raised from outside intergovernmental sources.⁸ We use the percentage of general fund revenues raised locally [REVPER] as a measure of agency costs related to taxpayer funding of services.⁹

We include the property tax rate [TAX] as a second proxy for taxpayer funding of services. Voters are more likely to be aware of the property tax rate, since it is subject to voter approval. The use of a second measure of taxpayer funding is also desirable since conflicting predictions have been made about the direction of the intergovernmental variable in previous municipal fee studies (Copley 1989; Deis and Giroux 1992b). We expect audit fees to be positively associated with the property tax rate and the percentage of locally-raised revenues.

Additional agency costs may arise due to the form of government. Zimmerman (1977) found that the demand for auditing is greater in the city-manager form of government than in the strong-mayor form.¹⁰ He attributed the increased audit demand to increased agency costs with the city-manager form of government. However, Copley (1989) argues that forms of government with professional managers are likely to have better control systems and lower audit costs. Accordingly, we include a variable for the city-manager form of government [MGR], but do not make a prediction as to the direction of the coefficient for this variable.

Similar to the city-manager variable, we include an indicator variable [TYPE] to distinguish city and township forms of government. Townships are a form of government common in the Midwest and Northeast. Relative to cities, elected officials perform more of township governance. Agency costs are reduced since the layer of management (appointed officials) between elected officials and the taxpayers is removed. However, the use of elected officials rather than professional managers may lower the quality of the control system. Accordingly, no prediction is made as to direction for this variable.

⁸ The percentage of revenues raised from intergovernmental sources is the inverse of taxpayer-funded resources. Accordingly, the intergovernmental revenue variable in Deis and Giroux (1992b) was expected to be negatively related to audit fees.

⁹ The intergovernmental revenue variable was referred to as a political variable in Copley (1991) and Deis and Giroux (1992b). Taxpayer funding of services likely has political ramifications. For example, Ingram and Copeland (1981) found that municipal accounting ratios contain information useful for explaining voter behavior. However, we refer to this measure as an agency cost since the variable is intended to capture monitoring incentives related to the agency relationship between taxpayer/voters and elected officials. We use the term political costs to refer to direct measures of political competition.

¹⁰ In the strong-mayor form of government, the elected mayor is primarily responsible for city operations. In the city-manager form of government, daily operations are managed by an appointed city manager who serves at the discretion of the city council or other elected body.

Political competition. Baber (1983) suggests that the demand for monitoring increases with the strength of political competition expected in future elections. In an empirical test of this model using a sample of North Carolina counties, Baber et al. (1987) found that audit fees were significantly associated with a partisan measure of political competition. Audit fees were not significantly associated with a nonpartisan measure based on commissioner turnover. Subsequent studies by Roberts and Glezen (1990) and Deis and Giroux (1992b) also did not find a relationship between nonpartisan political variables and governmental audit fees.

We incorporate both measures of political competition in our model to test whether audit fees are increasing with political competition. The nonpartisan measure of political competition is the percentage of elected officials not reelected in the two previous elections [TURNOVER]. This variable is consistent with the measures used by Baber et al. (1987), Ingram (1984), and Roberts and Glezen (1990). For entities that hold elections on a party basis, the partisan measure of political competition is defined as the percentage of elected seats held by the minority party [MINPAR].

Table 1 includes a description of the variables employed, the hypothesized relation of the variable to audit fees, and the data source for each variable.¹¹

II. Sample and Data Collection Procedures

We test the model using 1988 audit fees for Michigan municipalities. Use of this sample facilitated collection of additional data from financial statements, election results, and property tax records necessary for conducting our empirical tests. Michigan also has varied forms of governmental entities, and politics within the state are not dominated by one political party. Although selection of the sample from one state may limit the generalizability of our results, we believe that the variables used in this study are generalizable to other states and other governmental entities.

Surveys were mailed to the 216 cities and villages in Michigan with populations greater than 2,500 and the 141 townships with populations greater than 5,000 identified from directories issued by the Michigan Municipal League (1989) and Michigan Township Association (1989). A higher size cutoff was used for townships, since townships provide fewer services than cities. The surveys were mailed under cover letters from the Michigan Municipal Finance Officers Association and Michigan Township Association encouraging member responses to our survey.

Table 2 contains a summary of the survey responses. Observations were deleted if data were missing for one or more of the fee regression variables. The most common reason for deletion was failure to provide the number of audit adjustments. Usable responses were received from 92 cities and villages and 79 townships.¹² We collected additional variables for each respondent directly from their financial reports at the Bureau of Local Government Services for the State of Michigan. Property tax information was collected from a report of the State Tax Commission (1988). Election result information was collected from newspaper reports and by telephone interviews with city or township clerks.

To test for nonresponse bias, we compared respondents to nonrespondents based on population size. Nonrespondents were smaller, but not significantly so. We also compared early and late respondents and found no significant differences in revenues or population.

¹¹ The model admittedly includes a large number of variables. However, the importance of these variables has been suggested by previous research. Simplified models could be developed for other purposes. Killough and Koh (1991) use stepwise regression to estimate a three variable model for use by a governmental oversight agency for evaluating the reasonableness of audit fees.

¹² The city sample includes six villages. Results are not sensitive to the inclusion of these six observations in the sample.

Table 1
Description of Variables and Data Sources

<i>Measure</i>	<i>Label</i>	<i>Exp. Sign</i>	<i>Source</i>
Auditee Size:			
Log of total revenues	LREV	+	Financial Statement
Audit and Report Complexity:			
Number of significant funds	SFUNDS	+	Financial Statement
Audit on fund (combining) basis*	COMB	+	Financial Statement
Comprehensive Financial Report*	CAFR	+	Financial Statement
Tenure of finance officer (15 year max.)	FITEN	-	Survey
Number of journal entries	AJE	+	Survey
Qualified opinion-General Fixed Assets*	FAQUAL	-	Financial Statement
Qualified opinion-other*	OTQUAL	+	Financial Statement
Auditor Selection and Production:			
Audit was bid*	BID	-	Survey
Tenure of auditor (15 year max.)	AUDTEN	+	Survey
Audit during busy season*	BUSY	+	Financial Statement
Auditor belongs to Big-6*	BIG-6	+	Financial Statement
Auditor with most municipal experience*	EXPAUD	+	Financial Statement
Loss Exposure:			
Debt per capita	CAPDEBT	+	Financial Statement
Bond rating*	BONDRATE	+	Moody's Investor Service
Agency Costs:			
Percentage of revenues from property tax	REVPER	+	Financial Statement
Property tax rate	TAX	+	State directory
City manager form of government*	MGR	?	Survey
City/township form*	TYPE	?	Survey
Political Costs:			
Turnover of elected officials	TURNOVER	+	Newspaper/Telephone
Percentage of seats held by minority party	MINPAR	+	Survey/Newspaper

*Indicator variable: 1 if condition is true; 0 otherwise

Table 2
Sample Selection

	<i>Total # of Municipalities Located in Michigan</i>	<i>Surveys Mailed*</i>	<i>Responses Received</i>	<i>Response Rate</i>	<i>Usable Responses</i>
Cities	271	196	107	55%	86
Villages	263	20	9	45%	6
Townships	<u>1,242</u>	<u>141</u>	<u>99</u>	<u>70%</u>	<u>79</u>
Totals	<u>1,776</u>	<u>357</u>	<u>215</u>	<u>60%</u>	<u>171</u>

* Surveys were mailed to all Michigan cities and villages with a population greater than 2,500 and all townships with a population greater than 5,000.

III. Discussion of Results

The results of the audit fee model regression are contained in table 3. The dependent variable used in this study is the natural log of audit fees, consistent with previous studies.¹³ Results are not sensitive to any of the logarithmic transformations employed; however, examination of scatterplots indicated that such transformations increased the linearity of the relationships between the variables. We report separate results for cities and townships to examine the consistency of the model across governmental forms.

To the extent that audit fees are fixed by contract or competitive forces, the effects of short-term changes in the independent variables are less likely to be reflected in the audit fee. For example, because the size of the entity is fairly stable over time, size is likely to be fully incorporated in the cost of the audit. In contrast, changes in the political environment are more likely to be short-term in nature, and less likely to be reflected in the audit fee. However, audit fees for Michigan municipalities do not appear to be overly affected by contractual or competitive forces. For the entities in our sample, median auditor tenure is nine years, and only 31 percent of the audits were awarded based on competitive bid.

The adjusted R-squared value for the full sample was .83, with similar values for the city and township partitions. These R-squared values are significant at the .01 level and are higher than those for previous governmental audit fee models. The improvement in explanatory power over previous municipal audit fee models is attributable both to the inclusion of additional variables,

¹³ Our survey request was carefully worded to ensure that the indicated fee was only for audit services. The majority of the respondents (60%) indicated that they also received other services from their auditor; however, the fee for these additional services was usually quite small in relation to the audit fee.

Table 3
OLS Regression of 1988 log_e (Audit Fee)
on Explanatory Variables for Michigan Municipalities
(t-statistic in parentheses)

<i>Variables</i>	<i>Expected Sign</i>	<i>Total Sample (n = 171)</i>	<i>Cities (n = 92)</i>	<i>Townships (n = 79)</i>
Control Variables				
LREV	+	.3940 (11.048)***	.3040 (7.100)***	.5577 (7.771)***
SFUNDS	+	.0263 (1.961)**	.0354 (2.175)**	-.0003 (-.013)
COMB	+	-.0644 (-.836)	.0648 (.551)	-.2631 (-2.306)**
CAFR	+	.0771 (.780)	.1482 (1.495)*	N/A
FITEN	-	-.0034 (-.519)	.0034 (.387)	-.0096 (-.924)
BID	-	-.2112 (-2.365)***	-.2971 (-2.296)**	-.1232 (-.856)
AUDTEN	+	.0165 (2.055)**	.0093 (.749)	.0165 (1.453)*
BUSY	+	.0608 (.742)	-.0459 (-.336)	.1626 (1.420)*
BIG-6	+	.2506 (1.923)**	.3928 (2.791)***	N/A
CAPDEBT	+	-.0617 (-1.249)	-.0044 (-.088)	-.4041 (-1.603)
BONDRATE	+	.1248 (1.789)**	.0621 (.647)	.1994 (1.512)*
Added Explanatory Variables				
AJE	+	.0730 (4.089)***	.0651 (2.619)***	.0514 (1.940)**
EXPAUD	+	.6215 (6.893)***	.7949 (6.834)***	.3542 (2.475)***
FAQUAL	-	-.0759 (-.923)	-.0817 (-.745)	.0403 (.310)
OTQUAL	+	.0182 (.194)	-.0117 (-.105)	-.2779 (-1.389)
Agency and Political Variables				
REVPER	+	.0058 (2.147)**	.0039 (.976)	.0070 (1.683)**
TAX	+	.0149 (1.776)**	.0208 (2.198)**	-.0176 (-.800)

Continued

Table 3 (Continued)

MGR	?	-.0633 (-.704)	-.2217 (-1.818)*	.0842 (.527)
TYPE	?	-.1273 (-.811)	N/A	N/A
TURNOVER	+	.0013 (.924)	-.0008 (-.468)	.0018 (.654)
MINPAR	+	N/A	N/A	.0017 (.530)
Constant		5.057 (20.176)***	5.812 (12.870)***	4.205 (10.185)***
Adjusted R-Squared		.8278	.7954	.8264
F statistic		41.87***	19.62***	21.63***

See table 1 for a description of explanatory variables.

* Significant at the 0.10 level.

** Significant at the 0.05 level.

*** Significant at the 0.01 level.

All tests are one-tailed, except when a directional prediction is not made.

and the use of data collected directly from financial statements.¹⁴ The number of significant variables suggests that audit fees are related to multiple factors, consistent with previous audit fee research in the governmental and commercial sector.¹⁵

Added Explanatory Variables

Auditor experience. We include a dichotomous variable for the regional CPA firm that audited a significant portion of our sample. As predicted, the coefficient for this variable is positive and highly significant, suggesting the existence of a fee premium for auditor industry experience. However, it is also possible that this fee premium is attributable to political relationships or bundled non-audit services. We also tested a continuous measure of audit firm experience for all audit firms based on their number of municipal clients in our sample. This variable was positive, but insignificant. However, if the indicator variable for the firm with the largest market share is excluded, the continuous variable based on number of clients becomes significant.

An increasing amount of research in governmental and private sector settings has addressed the role of audit firm experience, with conflicting results. Palmrose (1986) was unable to find a fee premium for auditor experience for publicly-traded companies using a dichotomous measure of experience based on sales. Ettredge and Greenberg (1990) found that the first-year fee reduction is larger with the change to a more experienced auditor. This result is consistent with

¹⁴Results across different studies are not strictly comparable due to differences in the homogeneity of the samples and number of explanatory variables. We applied Rubin's model to our sample, except that the number of significant funds was used as a proxy for Rubin's number of activities (service index). The adjusted R² for Rubin's model was .64. Use of revenues rather than population as a measure of size increased the model adjusted R² to .69. Finally, the addition of the variables for audit adjustments and auditor experience increased the model adjusted R² to .81.

¹⁵The significance of the variables is unchanged using a stepwise regression approach.

lower fees due to auditor experience. However, a dichotomous measure designed to capture auditor expertise was associated with higher fees. Deis and Giroux (1992b) found that audit fees were lower with increased auditor experience for Texas school districts, but the relationship was not statistically significant.

The differences in results across studies may be due to the use of different experience measures, or the use of different audit markets. We note that fee premiums for experience were found using dichotomous measures, and that lower fees have been associated with continuous experience measures. The dichotomous measures may better capture reputation effects, while the continuous measures may better capture economies of scale. In a given audit market it may be possible for neither, either, or both types of pricing effects to exist. Further research is needed to identify the nature of audit firm expertise, and the conditions under which experience-related fee premia or fee reductions are expected to occur.

Number of adjusting entries. We also find that audit fees are positively associated with the number of audit adjustments. In addition to capturing the direct effect of audit adjustments on the cost of the audit, the number of audit adjustments may proxy for the level of inherent risk and control risk for the client. Increased levels of control and inherent risk would increase the required extent of audit testing and the cost of the audit. However, these adjustments appear to be an important element of the auditors' cost function in the governmental sector. The significance of the audit adjustment variable suggests that one way for municipalities to reduce their audit fees is to understand the nature of audit adjustments and try to correct them prior to the audit.

Opinion qualifications. We hypothesized that audit fees would be lower for fixed asset qualifications, and higher for other audit qualifications. However, the results provide little support for this hypothesis. The lack of significance for the qualification variables is consistent with Rubin (1988), Copley (1989) and Baber et al. (1987). The frequency of qualifications suggests that many qualifications represent recurring GAAP violations, which may require little additional audit effort. A more powerful approach to examine the relationship between municipal audit fees and qualifications would be to use prior year financial statements to identify first year qualifications and the removal of recurring qualifications, as these events are more likely to entail greater audit effort.

Control Variables Incorporated from Previous Research

The results for revenues, number of significant funds, CAFR reports, whether the audit was bid, auditor tenure, use of a Big-6 auditor, and bond rating are generally consistent with previous research. The variable for reporting on a combining basis had the opposite sign from that predicted for townships. We are unable to explain this result. Insignificant results were obtained for finance officer tenure, busy season audits, and debt per capita.

Although Rubin found a negative relation between audit fees and finance officer tenure, it is not clear that this relation should be expected. In some cases, a shorter finance officer tenure may reflect the upgrading of this position by hiring a more qualified finance officer. Deis and Giroux (1992b) also found an insignificant relation between audit fees and finance officer tenure.

Per capita debt may be an additional size proxy when population is used as the measure of size. When we measure size using population instead of revenues, the per capita debt variable becomes positive and significant. In our sample, per capita debt is more highly correlated with revenues than population. We also speculate that debt variables are more important measures of loss exposure for larger governmental units that have greater amounts of public debt. Per capita measures of debt were significant and positively related to audit fees in Rubin (1988) and Copley (1989). Both of these studies use samples drawn from large cities throughout the country. In

contrast, the debt measure in Roberts and Glezen (1990) for Texas school districts was insignificant.

Agency and Political Variables

Agency variables. We find evidence that audit fees are positively associated with the extent of taxpayer funding of services. There is a significant association between the percentage of revenues raised from local sources [REVPER] and audit fees in the combined and township samples. Audit fees are significantly related to the property tax rate [TAX] for the combined sample and for cities. However, this variable is insignificant for townships, which generally have low property tax rates and lower variation in these rates when compared to cities. The overall evidence is consistent with higher audit fees in highly-taxed environments, where public officials have incentives to demonstrate accountability to taxpayers. Although it generally has been believed that taxpayers are disinterested, the recent property tax reform movement suggests that taxpayers are concerned with the level of taxation, including property taxes. Future research may investigate cross-sectional differences in monitoring activities between high and low tax environments.

The coefficient for the existence of a city manager [MGR] is significantly negative for the city sample. This result is not consistent with increased agency costs in the city manager form of government, and is consistent with Copley's (1989) argument that city-manager governments are likely to have better control systems. The coefficient for government type [TYPE], which applies only to the combined regression, is insignificant. The results provide little support for increased auditing based on the form of government. However, the potential increased agency costs associated with government form may be confounded with the efficiency effects associated with more professional government.

Political variables. We find no significant relation between measures of political competition and municipal audit fees.¹⁶ The variable TURNOVER has the predicted sign in the combined and township samples, but is insignificant. This result is consistent with the results of Baber (1983), Baber et al. (1987), Roberts and Glezen (1990), and Deis and Giroux (1992a). The partisan competition variable [MINPAR], which applies only to townships, also has the predicted sign, but is insignificant. A partisan measure of competition was significant in Baber et al.¹⁷

The link between audit fees and measures of political competition is tenuous (Baber et al. 1987, 297). The lack of a strong relation between political competition and audit fees is consistent with the argument that auditing may not be the most effective monitoring device for many forms of political behavior. Researchers have found a relationship between measures of political competition and other monitoring signals, such as participation in the GFOA's Certificate of Excellence in Financial Reporting program (Evans and Patton 1983) or use of the NCGA's Statement #1 (Baber and Sen 1984). Measures of political competition may also be noisy measures in that they fail to consider other factors associated with turnover of elected officials, or the existence of elected officials from minority parties. Finally, the existence of political

¹⁶The demand for auditing arising from agency costs and political competition may result in a demand for a higher quality auditor, resulting in a higher audit fee. However, audit quality is included as an independent variable in the model. (We would like to thank Paul Copley for pointing this out.) However, the results for the political and agency variables are substantively unchanged when the Big 6 and experienced auditor variables are excluded from the model.

¹⁷Baber (1990) argues in favor of the use of dichotomous measures that distinguish between high and low political competition environments. The results were substantially unchanged using dichotomous forms of the two political competition variables. We also tested for the presence of interaction effects between the political and agency variables. For example, the demand for accountability from city-managers or elected officials may be greater in highly-taxed environments. However, we did not identify any significant interaction effects.

competition in a competitive auditing environment may exert a countervailing downward pressure on fees. In a climate of political competition, auditors may be reluctant to increase fees if doing so increases the probability of auditor change.

IV. Summary and Conclusions

We have expanded existing models of municipal audit fees by incorporating additional variables that reflect the complexity of accounting and auditing in the public sector. We find evidence of a fee premium based on industry-experience for a non-Big-6 firm. The nature of audit quality and the ability to detect experienced-based differences in audit quality may depend on the measure of experience and the nature of the audit market studied.

We found that audit adjustments are common in the governmental sector, and are a significant element of the audit cost function. The nature of these audit adjustments may be of future interest to investors and government officials that rely on municipal financial statements, and auditors in assessing the risk of municipal audit engagements. We also differentiate between classes of audit qualifications expected to have different effects on audit fees. However, we find no evidence of a relation between audit fees and audit qualifications. Future research may investigate the significance of municipal audit qualifications to users of municipal financial statements.

The existence of a relationship between audit fees and the extent of taxpayer funding of services suggests that municipal officials agree to additional monitoring to demonstrate they have been fiscally responsible with voter-supplied resources. These results suggest that public sector research should provide a greater role for taxpayer-related monitoring incentives. However, we find little evidence of a significant relationship between audit fees and agency costs arising from the form of government. One possible explanation is that the monitoring incentives related to form of government are confounded with efficiency effects related to government form.

We do not find support for a relation between audit fees and measures of political competition. Variables that proxy for the existence of political competition generally have the correct sign, but are insignificant. Accordingly, it does not appear necessary to incorporate measures of political competition in governmental audit fee models. However, political competition may be an important determinant of other monitoring signals. Future research should consider a broader set of incentives for monitoring in the public sector, including agency costs which proxy for the extent of taxpayer funding of services.

References

- Baber, W. R. 1983. Toward understanding the role of auditing in the public sector. *Journal of Accounting & Economics* 5 (December): 213-227.
- . 1990. Toward a framework for evaluating the role of accounting and auditing in political markets: The influence of political competition. *Journal of Accounting and Public Policy* 9 (Spring): 57-73.
- , and P. K. Sen. 1984. The role of generally accepted reporting methods in the public sector: An empirical test. *Journal of Accounting and Public Policy* 3 (Summer): 91-106.
- , E. H. Brooks, and W. E. Ricks. 1987. An empirical investigation of the market for audit services in the public sector. *Journal of Accounting Research* 25 (Autumn): 293-305.
- Copley, P. A. 1989. The determinants of local government audit fees: Additional evidence. *Research in Governmental and Nonprofit Accounting* 5: 3-23.
- . 1991. The association between municipal disclosure practices and audit quality. *Journal of Accounting and Public Policy* 10 (Winter): 245-266.
- Deis, D. R., and G. A. Giroux. 1992a. Determinants of audit quality in the public sector. *The Accounting Review* 67 (July): 462-479.
- , and ———. 1992b. Determinants of audit fees and audit hours using a direct audit quality measure. Working paper, Louisiana State University, Baton Rouge, LA.

- Ettredge, M., and R. Greenberg. 1990. Determinants of fee cutting on initial audit engagements. *Journal of Accounting Research* 28 (Spring): 198-210.
- Evans, III, J. H., and J. M. Patton. 1983. An economic analysis of participation in the Municipal Finance Officers Association certificate of conformance program. *Journal of Accounting and Economics* 5 (August): 151-175.
- Francis, J. R., and D. T. Simon. 1987. A test of audit pricing in the small client segment of the U.S. audit market. *The Accounting Review* 62 (January): 145-157.
- Hylas, R. E., and R. H. Ashton. 1982. Audit detection of financial statement errors. *The Accounting Review* 57 (October): 751-765.
- Ingram, R. W. 1984. Economic incentives and the choice of state government accounting practices. *Journal of Accounting Research* 22 (Spring): 126-144.
- , and R. M. Copeland. 1981. Municipal accounting information and voting behavior. *The Accounting Review* 56 (October): 830-843.
- Killough, L. N., and H. C. Koh. 1991. Projecting the audit fees of government audits contracted to public accounting firms. *Government Accountants Journal* (Summer): 65-68.
- Kreutzfeldt, R. W., and W. A. Wallace. 1986. Error characteristics in audit populations: Their profile and relationship to environmental factors. *Auditing: A Journal of Practice & Theory* 6 (Fall): 20-43.
- Michigan Municipal League. 1989. *Directory of Michigan Municipal Officials*. Ann Arbor, Michigan.
- Michigan Township Association. 1989. *Michigan Township Officials 1989-1992 Directory*. Lansing, Michigan: MTA.
- Palmrose, Z. 1986. Audit fees and auditor size: Further evidence. *Journal of Accounting Research* 24 (Spring): 97-110.
- Roberts, R. W., and G. W. Glezen. 1990. Determinants of school district audit fees. *Research in Governmental and Nonprofit Accounting* 6: 127-147.
- Rubin, M. A. 1988. Municipal audit fee determinants. *The Accounting Review* 63 (April): 219-236.
- Simunic, D. A. 1980. The pricing of audit services: Theory and evidence. *Journal of Accounting Research* 18 (Spring): 161-190.
- State Tax Commission, Department of Treasury. 1988. *Ad Valorem Property Tax Levy Report*. Lansing, Michigan: State of Michigan.
- Zimmerman, J. L. 1977. The municipal accounting maze: An analysis of political incentives. *Journal of Accounting Research* 15 (Supplement): 107-144.

capture the effects of the riskiness of equity on the expected rate of return on equity and, hence, on ERC. In particular, the default risk associated with the firm's debt would influence the ERC *only* through the effect that default risk has on equity beta, according to this equity valuation model. That is, within the context of the CAPM, the default risk of debt should have no incremental effect on the ERC after controlling for the effect of equity beta, when equity beta is measured without error.

The type of valuation model that we have outlined above has some important limitations as a basis for empirical estimation. The linkage between accounting earnings and expected dividends is ad hoc, as Collins and Kothari (1989) acknowledge. The model assumes that capital markets are perfect and complete. All of the impact of risk on the value of equity appears as an adjustment to the discount factor applied to expected future dividends. Ohlson (1990) points out that the notion of risk is general, and that the CAPM occurs only as a special case of a more general theory of security valuation. New cross-sectional evidence in Fama and French (1992) suggests that equity beta may be an incomplete or inappropriate proxy for risk adjustment.

Although Collins and Kothari (1989) and Easton and Zmijewski (1989) have documented a negative relationship between ERC and equity beta, the limitations of the valuation model suggest that other, more explicit measures of equity risk should be considered in a study of the determinants of the ERC. One such proxy for risk is the default risk of the firm's debt. Copeland and Weston (1988, 466-468) show a theoretical link between equity risk and default risk of debt. Empirically, Hand et al. (1992) find that unexpected downgrading announcements by bond rating agencies resulted in statistically significant negative abnormal returns for the affected firms. A plausible interpretation of this finding is that the market-perceived equity risk of a firm increases as the default risk of its debt (reflected in its bond rating) goes up.¹ Thus, given that there is concern regarding the validity of certain assumptions underlying the CAPM and estimation of equity beta involves measurement error, a higher default risk of debt for a firm may indicate greater riskiness associated with holding the firm's equity, apart from the effects the default risk of debt has on measured equity beta. In this case, a higher default risk of debt would lower the ERC, although this type of effect for default risk is not predicted to be present in the multiperiod CAPM equity valuation model. The purpose of this study is to examine empirically whether the ERC is negatively associated with the default risk of debt after controlling for equity beta and the earnings persistence factor.²

II. Empirical Investigation

Sample Selection

The sample of firms was drawn from the COMPUSTAT and CRSP tapes and was required to meet the following criteria: (1) Annual EPS data were available over the 1969-1988 period on the COMPUSTAT tapes to allow computation of the earnings persistence parameter; (2) sufficient return data for estimation of market model parameters were available on the CRSP daily

¹ An alternative interpretation of this finding is that expected future dividends decrease when the default risk of debt rises.

² This study should not be interpreted as a test of the validity of the (multiperiod) CAPM model. An empirical link between default risk of debt and the ERC, after controlling for measured equity beta, may arise because the CAPM provides an incomplete model of equity risk. Alternatively, it is possible that the multiperiod CAPM is the correct equity valuation model but that equity beta is measured with error. In this case, the default risk of debt may serve as an additional proxy measure of the underlying equity beta. In an empirical specification, a higher default risk of debt could result in a lower ERC, even after controlling for measured equity beta, when equity beta is subject to measurement error.

returns tape; (3) each firm had a fiscal year ending in December throughout the study period; and (4) bond-rating data were available on the quarterly COMPUSTAT tapes. Implementation of these criteria yielded a sample of 3,587 firm-year observations over the 11-year period 1978-1988. (Note that the first year of bond-rating data availability is 1978.)

Empirical Procedures

A conventional (or, direct) regression specification would use abnormal returns to equity as a dependent variable and unexpected earnings changes interacted with other factors as independent variables. We examined the relation between the default risk of debt and the ERC by using reverse regression. Unexpected earnings changes were regressed on cumulative abnormal returns (CARs) and a series of terms representing interactions between CARs and equity beta, earnings persistence factor and default risk. The following basic regression model was used:³

$$\frac{UX_{it}}{P_{i,t-1}} = a_0 + a_1 CAR_{it} + a_2 CAR_{it} * BETA_{it} + a_3 CAR_{it} * EPERS_i + a_4 CAR_{it} * DRISK_{it} + e_{it} \quad (3)$$

where

$$\begin{aligned} \frac{UX_{it}}{P_{i,t-1}} &= \text{ratio of unexpected earnings to previous period equity price for firm } i \text{ in year } t, \\ CAR_{it} &= \text{cumulative abnormal returns for firm } i \text{ in year } t, \\ BETA_{it} &= \text{equity beta of firm } i \text{ in year } t, \\ EPERS_i &= \text{earnings persistence for firm } i, \text{ and} \\ DRISK_{it} &= \text{default risk of firm } i\text{'s debt in year } t. \end{aligned}$$

Calculations of the variables in equation (3) are discussed below.

Recall that the predictions outlined earlier in this section are in terms of the relation between the earnings response coefficient and equity beta (-), earnings persistence (+) and default risk of debt (-). In reverse regression, these relations are inverted because we do not estimate the earnings response coefficient; instead, we estimate the abnormal return response coefficient. The abnormal return response coefficient is predicted to be positively related to equity beta and default risk of debt, and negatively related to the earnings persistence.

Measurement of Variables

Cumulative abnormal returns (CARs). Cumulative abnormal returns (CARs) were obtained by first estimating the following market model using monthly security returns:

$$R_{ik} = d_i + \beta_i R_{mk} + e_{ik} \quad (4)$$

where R_{ik} = continuously compounded rate of return on security i during month k ,
 R_{mk} = continuously compounded monthly rate of return on the equally weighted index during month k .

³ The reverse regression approach was employed in order to address the potentially severe measurement error problems with respect to unexpected earnings changes (Maddala 1977; Beaver et al. 1987). While reverse regression puts the measurement errors in unexpected earnings in the residual (barring any correlations with measurement error in the independent variables), it also suffers from measurement error biases. Because returns are reacting to information other than current period earnings, the independent variables in the reverse regression are also measured with error (see Lipe 1990). Thus, there is a trade-off between conventional and reverse regression, but we chose reverse regression consistent with prior research in the area (Collins and Kothari 1989).

The market model was estimated using up to 60 months preceding the period for which abnormal returns were cumulated. If fewer than 24 monthly return observations were available, the firm-year was excluded.

The estimated parameters from the market model $\hat{d}_i$ and $\hat{\beta}_i$ were used to calculate CARs as follows:

$$CAR_{it}[T1:T2] = \sum_{k=T1}^{T2} R_{ik} - \hat{d}_i - \hat{\beta}_i R_{mk} \quad (5)$$

T1 and T2 denote the beginning and ending months of the return-cumulation period. Two different cumulation periods—[January-December] and [April-March]—were used. For the latter cumulation period, the first return is that of April of year t , and the final return is that of March of year $t+1$. Because the results are very similar under the two periods, we report results based on the April through March period only.

Equity beta (BETA). Equity beta was measured by the coefficient β_i in equation (4) estimated as described earlier. Similar results were obtained when β_i was estimated using a 60-month estimation period centering around the period of the cumulation of abnormal returns.

Earnings persistence (EPERS). An IMA(1,1) model was estimated for each sample firm's earnings series for the 1969-84 period. Earnings persistence was then measured by subtracting the MA parameter estimate θ from one: $1 - \theta$.

Unexpected earnings (UX/P). A simple random walk model was assumed as the earnings generation process. That is, unexpected earnings were measured by the change in annual earnings per share deflated by price at the end of the prior year, $P_{i,t-1}$. Although many annual earnings/returns association studies use a random-walk model as a proxy for the market's earnings expectation as of the beginning of the year, it is inconsistent with using an IMA (1, 1) model to compute earnings persistence (Ali and Zarowin 1992). Therefore we also used the IMA (1, 1) model forecast error to compute unexpected earnings. The results obtained were qualitatively similar to those based on a random-walk assumption and are not reported.

Default risk of debt (BRAT). The default risk of debt was measured by bond ratings reported on COMPUSTAT. The default risk variable BRAT was assigned a value of one if bond ratings are lower than BBB+ (i.e., high default risk) and zero otherwise.⁴

Results

As described above, bond rating (BRAT) was used as a measure of the default risk of firm's debt in this study. Thus, the following modified version of equation (3) was estimated:

$$\frac{UX_{it}}{P_{i,t-1}} = a_0 + a_1 CAR_{it} + a_2 CAR_{it} * BETA_{it} + a_3 CAR_{it} * EPERS_i + a_4 CAR_{it} * BRAT_{it} + e_{it} \quad (6)$$

Summary statistics for variables in equation (6) for our sample are presented in table 1.

The results of estimating equation (6) are reported in table 2. The parameters in equation (6) were estimated by running a separate regression for each of the years 1978 through 1988. Each parameter estimate reported in table 2 is the sample mean of the parameter estimates from these eleven cross-sectional regressions, and the t-statistic was calculated from the standard error of the sampling distribution of parameter estimates. That is, the coefficients and t-statistics reported in

⁴ The BBB+ rating is the cutoff for investment grade bonds. We also ran the regression by assigning a range of values to the bond rating variable and the results were slightly weaker.

Table 1
Summary Statistics for the Market Model and the Regression Variables

<i>Variables</i>	<i>Mean</i>	<i>Median</i>	<i>Std. Dev.</i>	<i>Min.</i>	<i>Max</i>
β^a	.731	.695	.370	-.123	2.557
R-squared ^b	.311	.300	.140	.000	.761
$\sigma(\epsilon)^c$	.067	.071	.028	.025	.244
CAR[1:12]	.029	.027	.268	-1.669	1.993
CAR[4:15]	.027	.029	.291	-1.859	1.495
$\frac{UX_{it}}{P_{i,t-1}}^d$	.011	.024	.237	-1.581	1.700
Leverage ^e	.958	.661	1.183	.001	15.007
Size ^f	1647.71	590.00	4388.66	5.48	74508.40
EPERS ^g	.817	.853	.567	.013	1.957

N=3587 firm-years

^a Systematic risk from market model using equally weighted index.

^b R-square of market model estimation.

^c Standard deviation of market model residuals.

^d $\frac{UX_{it}}{P_{i,t-1}}$ is the ratio of unexpected earnings to previous period equity price. Values greater than 300% were excluded.

^e Ratio of book value of long-term debt to market value of equity.

^f Market value of equity at the beginning of the year (in millions of dollars).

^g Earnings persistence factor.

table 2 were derived from a series of eleven cross-sectional regressions. The inferences drawn based on this approach are not subject to the problems resulting from cross-sectional dependency described in Bernard (1987).

The results in table 2 are uniformly consistent with our expectations. The coefficients on CAR, and equity beta/CAR interaction, are positive and significant. The coefficient on earnings persistence/CAR interaction is negative and significant. Consistent with prior research findings (Collins and Kothari 1989; Easton and Zmijewski 1989; Kormendi and Lipe 1987), these results suggest that the earnings response coefficient is negatively related to equity beta and is positively related to earnings persistence. With respect to the focal point of the current study, the coefficient on bond rating/CAR interaction is positive and significant. This result implies that the earnings response coefficient is negatively related to default risk of debt as measured by bond ratings, after controlling for the effects of earnings persistence and equity beta.

It may be argued that the bond rating is a noisy measure of the default risk because it may not reflect the current riskiness of debt. To conduct a validity test, a second set of results was obtained by using the debt-to-equity ratio of a firm as an alternative measure of the default risk. This also allowed us to use a significantly larger sample (13,906 firm-years) because we were able to use the data for the period 1970 to 1988 rather than 1978 to 1988. These results which are not reported here strongly corroborate those reported in table 2 and are consistent with the results of Dhaliwal et al. (1991). It should be pointed out, however, that the negative relationship between the debt-

Table 2
Reverse Regression Result^a

$$\frac{UX_{it}}{P_{i,t-1}} = a_0 + a_1 CAR_{it} + a_2 CAR_{it} * BETA_{it} + a_3 CAR_{it} * EPERS_i + a_4 CAR_{it} * BRAT_{it} + e_{it}$$

<i>Independent Variable</i>	<i>Coefficient Estimate (t-statistic)</i>
Intercept	-.026 (2.155)*
CAR	.058 (2.991)**
CAR*BETA	.033 (1.992)*
CAR*EPERS	-.100 (4.008)**
CAR*BRAT	.013 (4.227)**

^aThe dependent variable $\frac{UX_{it}}{P_{i,t-1}}$ is the ratio of unexpected earnings to previous period equity price. The coefficient estimates and t-statistics are derived from a series of cross-sectional regressions

* = significant at .05 level using two-tail test

** = significant at 0.1 level using two-tail test

to-equity ratio and ERC observed in this study could be due to factors other than default risk. For example, the debt-to-equity ratio of a firm could be acting as a surrogate for upward bias and/or noise in a firm's reported accounting income. There is considerable empirical evidence that firms with high financial leverage tend to choose income-accelerating methods (Watts and Zimmerman 1986). It can be argued that the higher the debt-to-equity ratio, the closer the firm is to constraints in debt covenants and the greater the probability of incurring costs associated with a covenant violation. Managers choose income-accelerating accounting methods to avoid the costs of technical default. In the future periods, these accelerations would reverse themselves introducing noise in both the current period and some future periods. Thus, the debt-to-equity ratio could be acting as a surrogate for upward bias and/or noise in reported income which may be driving the observed negative relation between the ERC and debt-to-equity ratio. We repeated the above tests after controlling for methods of accounting for depreciation and inventory and obtained qualitatively similar results. We believe that the high leverage-high noise explanation is likely to be a second order effect relative to the default risk effect on the ERC.

III. Concluding Remarks

Several authors (including Collins and Kothari (1989) and Easton and Zmijewski (1989)) have argued that the earnings response coefficient is a negative function of the discount rate associated with a firm's earnings. Empirical investigations of this relation have relied on equity beta (estimated from a market model) as a measure of discount rate. In this paper, we suggest that equity beta is unlikely to capture fully the appropriate discount rate and that the default risk of debt may provide an additional proxy for the discount rate. Our empirical results indicate that the earnings response coefficient is negatively related to default risk of debt, after controlling for the effects of equity beta and earnings persistence.

References

- Ali, A., and P. Zarowin. 1992. Permanent versus transitory components of annual earnings and estimation error in earnings response coefficients. *Journal of Accounting and Economics* 15: 249-264.
- Beaver, W., R. Lambert, and S. Ryan. 1987. The information content of security prices: A second look. *Journal of Accounting and Economics* 9: 139-158.
- Bernard, V. 1987. Cross-sectional dependence and problems in inference in market-based accounting research. *Journal of Accounting Research* 25: 1-38.
- Collins, D. W., and S. P. Kothari. 1989. An analysis of intertemporal and cross-sectional determinants of earnings response coefficients. *Journal of Accounting and Economics* 11: 143-181.
- Copeland, T. E., and J. F. Weston. 1988. *Financial Theory and Corporate Policy*. New York, NY: Addison-Wesley.
- Dhaliwal, D., K. Lee, and N. Fargher. 1991. The association between unexpected earnings and abnormal security returns in the presence of financial leverage. *Contemporary Accounting Research* 8: 20-41.
- Easton, P., and M. Zmijewski. 1989. Cross-sectional variation in the stock market response to the announcement of accounting earnings. *Journal of Accounting and Economics* 11: 117-141.
- Fama, E. F. 1977. Risk-adjusted discount rates and capital budgeting under uncertainty. *Journal of Financial Economics* 5: 3-24.
- , and K. R. French. 1992. The cross-section of expected stock returns. *Journal of Finance* 47: 427-466.
- Hand, J., R. Holthausen, and R. Leftwich. 1992. The effect of bond rating agency announcements on bond and the CK return prices. *The Journal of Finance* 47: 733-752.
- Kormendi, R., and R. Lipe. 1987. Earnings innovations, earnings persistence and stock returns. *Journal of Business* 60: 323-345.
- Maddala, G. 1977. *Econometrics*. New York, NY: McGraw-Hill.
- Lipe, R. 1990. The relation between stock returns and accounting earnings given alternative information. *The Accounting Review* (Vol.65, No.1): 19-71.
- Ohlson, J. A. 1990. A synthesis of security valuation theory and the role of dividends, cash flows and earnings. *Contemporary Accounting Research* 6: 648-676.
- Watts, R., and J. Zimmerman. 1986. *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall.

between the various paradigms that underlie accounting research (e.g. behavioral science versus economics based research). *Research Method and Methodology in Finance and Accounting* helps bridge the divisions by providing an interesting and well illustrated discussion of both research methodology and philosophy of science issues within financial accounting and managerial accounting (and finance).

However, for a comprehensive seminar on accounting research it is incomplete in that major aspects of research dealt with in auditing, systems and tax research are not addressed at all. Examples that come to mind are cognitive modelling, expert systems development and validation, tax-based policy research and various types of process tracing research used in auditing (e.g. verbal protocol analysis and discourse analysis).

Research Method and Methodology in Finance and Accounting contains eleven chapters organized into three major parts. The first part is titled *Traditions of Research in Finance and Accounting* and contains a chapter on the philosophy of financial research and chapters on traditions of research in finance, management accounting and financial accounting. As noted in the text's Introduction, part one discusses difficult philosophical material that accounting PhD students need to be exposed to and the authors implore the reader to "stay the course" (p. viii). This is sometimes tedious, but well worth the effort. Strengths of Part 1 include the treatment of philosophical issues; frequent illustration of research issues through discussion of prominent research within finance, financial accounting and managerial accounting; and a thorough discussion of the historical development of financial and managerial accounting research.

Part 2, titled *Methods of Research*, presents chapters on methods of empirical research, on case study research, on interpretation of positive research and on the research output. The treatment of methods of empirical research introduces notions of scaling, experimental design, validity and hypothesis testing. However, the coverage is somewhat elementary and while it might be sufficient for the general reader, the treatment would need extensive augmentation for most doctoral students. A much more in depth treatment of methods of case study research and its role in science is contained in Chapter 7. This level of coverage is somewhat novel as compared to traditional texts dealing with accounting research. Even more novel and valuable for novice accounting researchers is the chapter on research output which contains discussion of postgraduate research and the ins and outs of publication of one's research in research journals, periodicals and books. This material would help motivate a reader and would be more effective if placed earlier in the text.

Part 3 is titled *Techniques of Critical Analysis* and includes chapters dealing with literature analysis, critical analysis of reasoning, and formal methods of analysis. The chapter on literature analysis is one that students at all levels should read, as little guidance of this nature is available from extant sources. These ideas are extended in the following two chapters that discuss methods of analyzing various types of natural language and logical reasoning including a two-stage approach to Natural Language Reasoning with illustrations from the accounting literature. Also discussed are formal methods of analysis based on propositional and predicate logic. Much of this material is new to most accounting research texts and would be of value to most of our students (and colleagues).

In summary, I found this text to contain a great deal of material that should be of value to accounting researchers. The presentation is even-handed and is not particularly partial to any one paradigm. The authors are able to present some of the more difficult issues in philosophy of science and useful illustrations of these issues in an accounting and finance context.

THEODORE J. MOCK

Arthur Andersen Alumni Professor

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PAUL R. WATKINS and LANCE B. ELIOT, *Expert Systems in Business and Finance: Issues and Applications* (New York: John Wiley & Sons, Inc., 1993, pp. xxi, 367, \$49.95).

There are few information systems (IS) topics that have enjoyed the highs and lows of academic and practitioner scrutiny as artificial intelligence (AI). Humanity's fascination with the notion of machine learning and intelligence has been a theoretical topic of discussion and research among academicians for over fifty years. Although AI researchers have experienced some success in the area, society and the press have always exaggerated the slightest success thereby making the expectations of AI sometimes impossible to achieve. Nonetheless, research in the area continues and the resulting body of knowledge continues to mature.

In a field as dynamic as AI it is useful to step back at times and take a look at the big picture. Without

this practice, researchers can often lose sight of the forest for the trees. One way to do so is to synthesize what has been done in an effort to define what needs to be done. Such is the purpose of *Expert Systems in Business and Finance: Issues and Applications*.

Watkins and Eliot call on several recognized experts in the area to both summarize what has happened and offer suggestions regarding what needs to happen to further the work of AI and its application to the business world. The book is not intended to be exhaustive. Instead, it focuses the contributions of the participants on the following topics:

- Issues in the design and integration of expert systems

- Issues in the modeling of human judgment for expert systems

- Issues in validation, auditability and security of expert systems

- Legal issues, training effects, and financial and resource planning application of expert systems

The insights of the contributing authors raise several interesting issues regarding both the applicability and further development of expert systems concepts and technology.

Part 1 of the book focuses on an extremely important issue of integrating the use of AI with business information systems at large. Unfortunately, the discussion is dominated by a focus on integrating AI with conventional business system architectures. The primary problem with integrating AI technology with such systems is these conventional systems have such poor data integration that useful integration is not realistic until the architecture of conventional business systems is changed.

Part 2 provides some very useful insights regarding the challenges facing those building computational models of human reasoning. The section concludes with one of the longest circulating working papers among AI researchers in accounting which addresses the architecture of expertise by Mallory Selfridge and Stan Biggs at the University of Connecticut. This section alone justifies acquiring the book.

Part 3 focuses on control and auditability issues relating to AI. Although useful, the papers in part 3 do not build upon the issues and topics addressed in part 2, particularly the notion of an alternative architecture of expertise instead of one dominated largely by rule-based systems. Unfortunately, the discussion of the application of AI to auditing is dominated by a regulation-, rather than value-, driven mentality. Given the pressure on the audit industry to increase its value, perceived or otherwise, it seems JAI technology should be viewed as being more than something to pave cow paths.

Part 4 raises an interesting potpourri of social issues regarding AI and its use in business. The contributions in this part range from a discussion of legal issues in applying AI to surveys of the use of AI in practice.

In all, I think this book would be a useful addition to the bookshelf of those working on the development and use of AI in business. It will by no means make you current with the domain in its entirety, but it will provide some useful food for thought for the neophyte and expert alike.

ERIC L. DENNA

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BOOKS RECEIVED JULY 23, 1993 TO NOVEMBER 1, 1993

ROBERT N. ANTHONY and DAVID W. YOUNG, *Management Control in Nonprofit Organizations* (Homewood, IL: Richard D. Irwin, Inc., 1994, pp. xxi, 919, \$59.95).

KENNETH E. BOULDING, *The Structure of a Modern Economy* (New York: New York University Press, 1993, pp. xii, 215, \$60.00).

CANADIAN INSTITUTE OF CHARTERED ACCOUNTANTS, *Environmental Costs and Liabilities* (Toronto: The Canadian Institute of Chartered Accountants, 1993, pp. xii, 129, \$34.50).

SAMUEL A. CYPERT, *The Success Breakthrough* (New York: Avon Books, 1993, pp. xiii, 240, \$4.99).

ERIC L. DENNA, J. OWEN CHERRINGTON, DAVID P. ANDROS, and ANITA SAWYER HOLANDER, *Event-Driven Business Solutions* (Burr Ridge, IL: Richard D. Irwin, Inc., 1993, pp. ix, 168, \$40.00).

CAROLE DILWORTH and JOANE D. CONROD, *Canadian Cases in Financial Accounting* (Homewood, IL: Richard D. Irwin, Inc., 1993, pp. xii, 370).

EMPLOYEE BENEFIT RESEARCH INSTITUTE, *Time Horizons of Pension Fund Managers* (Morristown, NJ: Financial Executives Research Foundation, 1993, pp. 36).

- ERNST & YOUNG, *Ernst & Young's Guide to the New Tax Law* (New York: John Wiley & Sons, Inc., 1993, pp. xivi, 210, \$5.95).
- ROBERT FEINSCHREIBER, ed., *Transfer Pricing Handbook* (New York: John Wiley & Sons, Inc., 1993, pp. xvi, 629, \$125.00).
- FINANCIAL ACCOUNTING STANDARDS BOARD, *A Guide to Implementation of Statement 106 on Employers' Accounting for Postretirement Benefits Other Than Pensions* (Norwalk, CT: Financial Accounting Standards Board, 199e, pp. vii, 55).
- JOHN J. GLYNN, *Public Sector Financial Control and Accounting* (Cambridge, MA: Blackwell Publishers, 1993, pp. xii, 301, \$34.95).
- ROBERT E. HOSKIN, *Financial Accounting: A User Perspective* (New York: John Wiley & Sons, Inc., 1994, pp. xxiii, 967, \$46.00).
- YUJI IJIRI, ed., *Creative and Innovative Approaches to the Science of Management* (Westport, CT: Quorum Books, 1993, pp. xxii, 528, \$59.95).
- STUART JONES, COLIN RICKWOOD, and SHEILA GREENFIELD, *Accounting Control and Management Philosophies* (London: The Institute of Chartered Accountants in England and Wales, 1993, pp. 173, £10.00).
- KEVIN KEASEY and ROBERT WATSON, *Small Firm Management* (Cambridge, MA: Blackwell Publishers, 1993, pp. ix, 262, \$29.95).
- R. K. McCABE, *The Accountant's Guide to Peer and Quality Review* (Westport, CT: Quorum Books, 1993, pp. xix, 226, \$55.00).
- ELLEN MESSER-DAVIDOW, DAVID R. SHUMWAY, and DAVID J. SYLVAN, *Knowledges: Historical and Critical Studies in Disciplinarity* (Charlottesville: University Press of Virginia, 1993, pp. viii, 466, \$19.95).
- GERHARD G. MUELLER, HELEN GERNON, and GARY K. MEEK, *Accounting: An International Perspective* (Burr Ridge, IL: Richard D. Irwin, Inc., pp. xv, 200, \$28.00).
- NAN HELDENBRAND MORRISSETTE, *Setting Up a Bank Records Management Program* (Westport, CT: Quorum Books, 1993, pp. x, 192, \$55.00).
- GRANT W. NEWTON and GILBERT D. BLOOM, *Bankruptcy & Insolvency Taxation* (John Wiley & Sons, Inc. 1994, pp. xiii, 695, \$125.00).
- JAMES W. PRATT and WILLIAM N. KULSRUD, *Corporate, Partnership, Estate and Gift Taxation* (Burr Ridge, IL: Richard D. Irwin, Inc., 1993, \$59.95).
- JAMES W. PRATT and WILLIAM N. KULSRUD, *Federal Taxation* (Burr Ridge, IL: Richard D. Irwin, Inc., 1993, \$62.95).
- JAMES W. PRATT and WILLIAM N. KULSRUD, *Individual Taxation* (Burr Ridge, IL: Richard D. Irwin, Inc., 1993, \$58.95).
- HOWARD M. SCHILIT, *Financial Shenanigans* (New York: McGraw-Hill, Inc., 1993, pp. xv, 191, \$22.95).
- JAMES STONER and FRANK WERNER, *Finance in the Quality Revolution* (Morristown, NJ: Financial Executives Research Foundation, 1993, pp. 163).
- JOHN A. TRACY, *How to Read a Financial Report*, 4th ed. (New York: John Wiley & Sons, Inc., 1994, pp. 168, \$14.95).
- JIM WALTZ and DON HIPSCHMAN, *101 Uses for a Dead IRS Agent* (Saratoga, CA: R & E Publishers, 1992, pp. 116, \$10.40).
- JOHN W. WRIGHT, *The American Almanac of Jobs and Salaries* (New York: Avon Books, 1992, pp. xxxviii, 638, \$17.00).

EDITORIAL POLICY AND STYLE INFORMATION

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A synopsis of about 400 words should be presented on a separate page immediately preceding the text. The synopsis also serves as the "introduction." The synopsis should be nonmathematical and include a readable summary of the research question, method, and the significance of the findings and contribution. The title, but not the author's name or other identification designations, should appear on the synopsis page.

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- Dye, R., B. Balachandran, and R. Magee. 1989. Contingent fees for audit firms. Working paper. Northwestern University, Evanston, IL.
- Fabozzi, F., and I. Pollack, eds. 1987. *The Handbook of Fixed Income Securities*. 2d ed. Homewood, IL: Dow Jones-Irwin.
- Kahneman, D., P. Slovic, and A. Tversky, eds. 1982. *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge, United Kingdom: Cambridge University Press.
- Porcano, T. M. 1984a. Distributive justice and tax policy. *The Accounting Review* 59 (October): 619–36.
- . 1984b. The perceived effects of tax policy on corporate investment intentions. *The Journal of the American Taxation Association* 6 (Fall): 7–19.
- Shaw, W. H. 1985. Empirical evidence on the market impact of the safe harbor leasing law. Ph.D. dissertation, University of Texas, Austin.
- Sherman, T. M., ed. 1984. *Conceptual Framework for Financial Accounting*. Cambridge, MA: Harvard Business School.

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3. Four copies should be submitted together with a check in U.S. funds for \$50.00 for members or \$100.00 for nonmembers of the AAA made payable to the American Accounting Association. Effective January 1990, the submission fee is nonrefundable.
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Performance Measure Congruity and Diversity in Multi-Task Principal/Agent Relations

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SYNOPSIS AND INTRODUCTION: Accounting numbers are frequently used in evaluating management performance, and performance evaluation is an important ingredient in motivating managers. Three significant factors generally create difficulties in developing performance measures for a given manager. First, the actions and strategies implemented by the manager are not observable directly, so the manager cannot be compensated directly for his input into the firm. Second, the full consequences of the manager's actions are not observable, in large part because the impact of those actions extend beyond his subunit of the firm and beyond his time as manager of that subunit. Third, uncontrollable events influence the consequences that are observed.

The agency theory literature has explored extensively the implications of the nonobservability of the manager's actions and the fact that performance measures are influenced by unobservable, uncontrollable events. However, this literature has given only limited attention to the fact that performance measures frequently are incomplete or imperfect representations of the economic consequences of the manager's actions.¹

On the other hand, discussions of performance evaluation in management accounting texts often raise issues regarding the incompleteness and imperfectness of the accounting numbers that are used as performance measures. For example,

¹These issues are not completely ignored in the agency theory literature. See, for example, the multiperiod models examined by Magee (1978; 1986, ch. 14), Baiman and Noel (1985), Dye (1988), Kanodia et al. (1989), and Bushman and Indjejikian (1993).

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divisional accounting profit is described as a short-term financial measure that may induce managers to ignore the future economic consequences of their current actions.² More generally, management accounting texts discuss various problems that arise in inducing managers to have goals that are *congruent* with those of the firm's owners.³ These discussions typically follow one of two tacks. First, most texts discuss alternative methods for measuring various accounting numbers. For example, discussions of divisional profit measures often consider direct costing versus absorption costing, the elimination of allocated fixed costs, market versus cost based transfer prices, and the inclusion of interest charges for assets used. The objective here is to create a *single* measure that is as congruent with the firm's objectives as possible.

Second, some texts discuss the use of additional, often nonfinancial, performance measures. Kaplan and Atkinson (1989, 536) refer to General Electric and McDonald's as leaders in the use of such measures, and Anthony et al. (1992, 651) provide the following summary of their measures.

McDonald's evaluated its store managers on product quality, service, cleanliness, sales volume, personnel training, and cost control.

When General Electric decentralized in the 1950s, it identified multiple measures of divisional performance: profitability, market position, productivity, product leadership, personnel development, employee attitudes, and public responsibility.

This paper uses an agency theory model to explore the economic impact of variations in performance measure congruence and the use of multiple performance measures to deal with both problems of goal congruence and the impact of uncontrollable events on performance measures. To address the congruency issues, we use a multidimensional representation of the manager's actions. Most of the agency theory literature has examined models in which the manager's action space is either single dimensional or finite. Our approach is similar to the multi-task model examined by Holmstrom and Milgrom [HM] (1991). Our analysis differs from theirs in that we focus on performance measure issues and consider measures that may be influenced by more than one element of the manager's action.

The key characteristics of a single performance measure are its congruence with the principal's expected gross payoff and its noisiness (due to uncontrollable events). The first-best result is achieved if, and only if, the performance measure is *perfectly congruent and noiseless*. A contract based on a noncongruent measure induces suboptimal effort allocation across tasks, whereas performance measure noise results in suboptimal effort intensity.

We characterize the value of providing additional performance measures, and illustrate the use of additional measures to reduce risk and noncongruity (due to myopia and window dressing). The value of an additional measure is zero if, and only if, the existing measures constitute a sufficient statistic for the additional measure with respect to the manager's action.

² See, for example, Magee (1986, 267), Horngren and Foster (1991, 892-894), and Anthony et al. (1992, 649-651).

³ See Kaplan and Atkinson (1989, 534-540) for a general discussion of this issue.

The terminal value of the firm is not contractible information if it is realized subsequent to the contract termination date. However, the market price (at the contract termination date) of a publicly traded firm is contractible information. The analysis demonstrates that while price efficiently aggregates investor information for valuation purposes, it is not likely to be an efficient aggregation for incentive purposes. Hence, there is a loss of efficiency if the price is used as the sole performance measure. Of course, it can be a valuable performance measure if it contains otherwise noncontractible information.

Key Words: *Multi-task agencies, Multiple performance measures, Congruity, Price based compensation.*

THE remainder of the paper is organized as follows. The basic multi-task principal/agent model is specified in section I, along with a characterization of the first-best contract. The second-best results with a single performance measure are examined in section II. A general characterization of the value of additional performance measures is provided in section III, while special cases of noise reduction and congruity improvement are examined in section IV. The impact of using the market price (at the contract termination date) as a performance measure is examined in section V and concluding remarks are provided in section VI.

I. Basic Model

An agent (a manager) controls n activities that influence the payoff to the principal (representing the owners of the firm employing the agent). These activities can pertain to different divisions, different products, or to management of a variety of activities such as marketing, production, personnel development, and product research. The set of feasible activity levels is represented by an n -dimensional set of non-negative real numbers, denoted $A \equiv \mathbb{R}^{n+}$, and the agent's action choice is represented by the vector⁴ $a = (a_1, \dots, a_n)^t$.

The principal is risk neutral (e.g., the firm's owners are well diversified and all risks are firm-specific) and his gross payoff (prior to the agent's compensation) is denoted x . The relation between the agent's action and x is assumed to take the form

$$x = B(a) + \varepsilon_x,$$

where $B(a)$ is the expected gross payoff and $\varepsilon_x \sim N(0, \sigma_x^2)$ is a random uncontrollable component of the gross payoff. The variance of the uncontrollable component is assumed to be independent of the agent's action choice.

The agent is risk averse and incurs a direct personal cost, denoted $C(a)$, if he implements action a . His preferences are represented by a negative exponential utility function $u(W) = -e^{-rW}$, where r is the agent's absolute risk aversion and W is *his compensation minus personal cost*.

We restrict $B(a)$ and $C(a)$ to simple forms that induce closed form interior solutions. In particular, we assume $B(a)$ is linear and $C(a)$ is separable and quadratic:⁵

$$B(a) = b'a = b_1 a_1 + \dots + b_n a_n$$

⁴ Bold face is used for vectors and matrices, all vectors are column vectors, and "''" denotes transpose.

⁵ HM provide a number of interesting insights by considering a variety of benefit functions $B(a)$ and personal costs $C(a)$. We use a simple linear/quadratic form since this is adequate to provide a number of interesting insights into the impact of alternative performance measures. $B(a)$ and $C(a)$ could also include fixed components without changing the analysis.

$$C(\mathbf{a}) = \frac{1}{2} \mathbf{a}' \mathbf{a} = \frac{1}{2} [a_1^2 + \dots + a_n^2],$$

where $\mathbf{b} = (b_1, \dots, b_n)'$, $b_j \geq 0$, represents the payoff per unit of effort in the two tasks.

If $\mathbf{a}$ is publicly observable and contractible, then there is no incentive problem. As is well known, the first-best contract consists of a fixed wage w^* that is sufficient to obtain the agent's acceptance of the contract given that he must provide the first-best action $\mathbf{a}^*$, i.e., $w^* = C(\mathbf{a}^*) + w^0$, where w^0 is the agent's reservation wage. Given the assumed forms for $B(\mathbf{a})$ and $C(\mathbf{a})$, the first-best action is characterized by the following first-order condition:

$$a_j^* = b_j, \quad j = 1, \dots, n. \quad (1)$$

That is, effort is expended in each task up to the point at which its marginal cost to the agent (which equals a_j) is equal to its marginal benefit to the principal (which equals b_j). The cost to the agent is relevant to the principal because he must reimburse the agent for that cost. The first-best contract provides an *expected surplus* (the principal's expected gross payoff minus the agent's personal cost) of

$$V^* \equiv B(\mathbf{a}^*) - C(\mathbf{a}^*) = \frac{1}{2} \mathbf{b}' \mathbf{b} = \frac{1}{2} [b_1^2 + \dots + b_n^2]. \quad (2)$$

If $\mathbf{a}$ is not publicly observable, then the principal faces an incentive problem. We assume that the incentive contract must be based on a vector of publicly reported performance measures, denoted $\mathbf{y} = (y_1, \dots, y_m)'$, that are produced by performance measurement system η . As discussed in the introduction, these performance measures can include both accounting and nonaccounting numbers.

We assume that the principal's gross payoff is *not contractible information* (i.e., x is not, in general, an element of $\mathbf{y}$), which is consistent with settings in which the agent manages a subunit of the firm or his contract terminates prior to the full realization of the consequences of his actions. In the final section of the paper, we consider a setting in which the firm's market price at the contract termination date is used as a performance measure.⁶

For simplicity and following HM, we assume $\mathbf{a}$ has only a mean-shifting effect on these measures. We further assume that there is a linear relation between the agent's actions and the expected levels of the performance measures. Hence,

$$\mathbf{y} = \boldsymbol{\mu} \mathbf{a} + \boldsymbol{\varepsilon},$$

i.e.,

$$y_i = \mu_{i1} a_1 + \dots + \mu_{in} a_n + \varepsilon_i \quad i = 1, \dots, m, \quad (3)$$

where $\boldsymbol{\mu} = [\mu_{ij}]_{m \times n}$ is a matrix of performance measure parameters and $\boldsymbol{\varepsilon} = (\varepsilon_1, \dots, \varepsilon_m)'$ is an $m \times 1$ vector of normally distributed random variables with mean zero and covariance matrix $\boldsymbol{\Sigma}$.⁷ Unless stated otherwise, we assume throughout our analysis that $\boldsymbol{\Sigma}$ is positive definite (p.d.) and,

⁶Bushman and Indjejikian (1993) provide a model in which $\mathbf{y} = (y_1, y_2)$, where y_1 is interpreted an accounting number and y_2 is the firm's post-action market price. The market price reflects investors' rational expectations given the accounting number and information they have privately acquired.

⁷Much of HM's analysis focuses on the impact of alternative forms of $C(\mathbf{a})$ and they simplify the impact of the performance measures by assuming that each measure is influenced by a single task (although there need not be a measure for each task), i.e., $\mu_{ij} = 0$, for $i \neq j$ and $\mu_{ii} = 1$ if there is a measure for task i (and 0 otherwise). In contrast, we are interested in measures, such as accounting reports, that are influenced by the effort expended in more than one task. Hence, we allow for the possibility that μ_{ij} may be nonzero for any i, j .

HM point out that there is no loss of generality in assuming there is a single performance measure for each task, since the tasks can be defined such that agent chooses the expected performance level for each measure. However, that approach is not very useful when one is examining the impact of alternative performance measures.

hence, Σ^{-1} exists. The vector ε represents uncontrollable events influencing the performance measures.

We *exogenously* restrict our analysis to contracts in which the wage payment is a *linear* function of the performance measure(s) y :^{8,9}

$$w(y) = \beta + \mathbf{v}^t \mathbf{y} = \beta + \sum_{i=1}^m v_i [\mu_{i1} a_1 + \dots + \mu_{in} a_n + \varepsilon_i], \quad (4)$$

where β is the fixed component of compensation and $\mathbf{v} = (v_1, \dots, v_m)^t$ is an $m \times 1$ vector of incentive compensation coefficients. We can view v_i as the price paid per unit of performance measure i that is produced, whereas β is a fixed payment that is independent of the performance measures.

The key element of the contract is its incentive component $\mathbf{v}$, since the fixed component β merely serves to ensure that the compensation contract is accepted. The incentive component is used to induce positive effort by the agent, but in so doing imposes risk. The total variance in the agent's income is $\mathbf{v}^t \Sigma \mathbf{v}$, and he must be paid a risk premium of $\frac{1}{2} r \mathbf{v}^t \Sigma \mathbf{v}$ to compensate for that risk. Hence, if the agent is offered incentive contract $\mathbf{v}$, which induces action $\mathbf{a}$, then the expected cost to the principal is $\frac{1}{2} r \mathbf{v}^t \Sigma \mathbf{v} + C(\mathbf{a}) + w^0$. The reservation wage is immaterial to the choice of $\mathbf{v}$ and $\mathbf{a}$. Hence, with respect to the choice $\mathbf{v}$ and $\mathbf{a}$, the principal's problem, for performance measurement system η , can be expressed as the maximization of the *expected surplus*:¹⁰

$$V(\mathbf{a}, \mathbf{v}, \eta) \equiv B(\mathbf{a}) - [\frac{1}{2} r \mathbf{v}^t \Sigma \mathbf{v} + C(\mathbf{a})], \quad (5)$$

subject to incentive constraint

$$\mathbf{a} = \mu^t \mathbf{v}, \quad (6)$$

which is the first-order condition for the agent's decision problem.¹¹

The solution to the principal's problem is¹²

$$\mathbf{v}^* = Q \mu \mathbf{b} \quad (7)$$

and

$$\mathbf{a}^* = \mu^t \mathbf{v} = D \mathbf{b}, \quad (8)$$

where

$$Q \equiv [\mu \mu^t + r \Sigma]^{-1}$$

and

$$D \equiv \mu^t Q \mu.$$

⁸ HM also restrict their analysis to linear contracts. They make reference to the dynamic model used by Holmstrom and Milgrom (1987) to specify a setting in which linear contracts are optimal. We do not appeal to their analysis since their setting does not fit "naturally" into a setting, such as ours, in which there are multiple performance measures that are observed by both the principal and the agent. Hence, we make no claim that a linear contract is optimal.

Gjesdal (1981; 1982) provides a general characterization of optimal contracts in a multi-task setting. Matsumura (1988) examines optimal contracts in a setting in which the agent allocates time across tasks (e.g. sales of products). She considers both the simultaneous and sequential choice of effort levels.

⁹ A linear contract can be interpreted as consisting of a linear aggregation of the performance measures and a linear incentive contract based on the aggregate performance measure. See Banker and Datar (1989) and Amershi et al. (1990) for analyses of conditions under which linear aggregation of performance measures is optimal in a single-task setting. Generally, even if it is optimal to linearly aggregate performance measures, the optimal contract is not a linear function of the aggregate measure.

¹⁰ See HM for a more detailed development of the argument that the principal's problem is equivalent to maximizing the expected surplus.

¹¹ The agent's objective is to maximize $\mathbf{v}^t \mu \mathbf{a} - C(\mathbf{a})$. The incentive constraints are the first-order conditions to this problem.

¹² Substituting equation (6) into equation (5) suppresses $\mathbf{a}$ and eliminates the incentive constraints, so that the principal's problem can

The resulting second-best expected surplus is

$$V(\eta) = \frac{1}{2} b' D b. \quad (9)$$

We now examine how the characteristics of $\eta \equiv (\mu, \Sigma)$ influence $v^\dagger$, $a^\dagger$, and $V(\eta)$. In this exploration we make comparisons between the second-best and first-best levels of effort and surplus. That is, we compare $a^\dagger$ to a^* and we examine the *loss of surplus* resulting from η , where the loss in surplus is

$$L(\eta) \equiv V^* - V(\eta) = \frac{1}{2} b' [I - D] b. \quad (10)$$

II. Single Performance Measure Congruity and Precision

Many incentive contracts are based on a single performance measure ($m = 1$), even if the agent's action is multidimensional. This section demonstrates that the loss in surplus in this setting can be viewed as a function of the performance measure's *congruity* and *precision*. Congruity refers to the degree of congruence between the impact of the agent's action on his performance measure and on the principal's expected gross payoff, while precision refers to the noise in the performance measure. A simple example of differences in congruity is the evaluation of a salesman, who sells several products, on the basis of total sales dollars versus total contribution margin. We generally view maximization of the total contribution margin to be more congruent with the firm's objectives than maximization of total sales, since the former recognizes the incremental costs of the sales whereas the latter does not. Similarly, residual income is generally viewed as more congruent with the firm's objectives than divisional profit since the former considers the cost of the capital tied up in divisional assets. Of course, all of the above measures are inherently noisy in that they are influenced by uncertain, uncontrollable events.

In the two-task ($n = 2$) setting, performance measurement system η is characterized by $\mu = [\mu_{11} \mu_{12}]$ and $\Sigma = \sigma_1^2$. To avoid degeneracy we assume $b_1, \mu_{11} > 0$ and $b_2, \mu_{12} \geq 0$. From first order conditions (7) and (8) we obtain

$$v^\dagger = \frac{b_1 \mu_{11} + b_2 \mu_{12}}{\mu_{11}^2 + \mu_{12}^2 + r \sigma_1^2}$$

and

$$a_j^\dagger = v^\dagger \mu_{1j}, \quad j = 1, 2.$$

Observe that the denominator of the incentive function's slope parameter, $v^\dagger$, is an increasing function of $r \sigma_1^2$, which implies that $v^\dagger$ and $a_j^\dagger$, all j , are decreasing functions of $r \sigma_1^2$. For both tasks,

be expressed as:

$$V(\eta) = \max_{\mathbf{v}} b' \mu' \mathbf{v} - \frac{1}{2} [r \mathbf{v}' \Sigma \mathbf{v} + \mathbf{v}' \mu \mu' \mathbf{v}].$$

Now the incentive contract is the sole object of choice and the induced action is implicit in the analysis. Differentiating $V(\eta)$ with respect to $\mathbf{v}$ provides the first-order condition (7). Substituting (7) into (6) provides (8).

This analysis assumes Q exists, which is true as long as there is no performance measure y_i such that either $\mu_{ij} = r \sigma_{ik} = 0$ for all $j=1, \dots, n$ and $k=1, \dots, m$, or $\mu_{ij} = \sum_{\ell \neq i} \xi_\ell \mu_{\ell j}$ and $r \sigma_{ik} = r \sum_{\ell \neq i} \xi_\ell \sigma_{\ell k}$ for some $\{\xi_\ell\}_{\ell \neq i}$. Any such measure can be eliminated without consequence, since the measure is either a constant or redundant. The existence of Q follows from the fact that $\mu \mu'$ and $r \Sigma$ are always positive semidefinite, and their sum is positive definite as long as the above conditions do not hold (the inverse of a positive definite matrix always exists).

an increase in risk aversion or noise reduces the intensity of the effort induced by the second-best contract.

Further observe that the relative effort expended in the two tasks is equal to their relative impact on the performance measure (irrespective of r and σ_1^2):

$$\frac{a_2^\dagger}{a_1^\dagger} = \frac{\mu_{12}}{\mu_{11}}.$$

In the first-best action, on the other hand, the relative effort expended in the two tasks is proportional to their relative contributions to the principal's expected gross payoff:

$$\frac{a_2^*}{a_1^*} = \frac{b_2}{b_1}.$$

The following specifies a measure of noncongruity between a performance measure and the principal's expected gross payoff. We refer to a performance measure as being perfectly congruent with the principal's gross payoff if there is zero noncongruity.

Definition: The *measure of noncongruity* for performance measure y_i relative to the principal's gross payoff, is¹³

$$\delta_i \equiv [b_1\mu_{i2} - b_2\mu_{i1}]^2.$$

Performance measure y_i is *perfectly congruent* with b if its measure of noncongruity is zero.

Observe that y_i is perfectly congruent if, and only if, there exists a constant $\lambda_i \neq 0$ such that $\mu_{ij} = \lambda_i b_j$, $j = 1, 2$.

The impact of noncongruity and noise on the principal's expected net payoff is reflected in the following specification of the loss of surplus (which follows from equation (10)):

$$L(\eta) = \frac{\delta_1 + \frac{1}{2} r \sigma_1^2 (b_1^2 + b_2^2)}{\mu_{11}^2 + \mu_{12}^2 + r \sigma_1^2}. \quad (11)$$

The first term, δ_1 , reflects the loss due to noncongruity, and the second term, $\frac{1}{2} r \sigma_1^2 (b_1^2 + b_2^2)$, reflects the loss due to performance measure noise.

From equation (11) it is obvious that a single performance measure can only achieve the first-best result if it is both perfectly congruent *and* noiseless (or the agent is risk neutral).

Proposition 1: If there is a single performance measure ($m = 1$), then $L(\eta) = 0$ if, and only if, $r \sigma_1^2 = 0$ and there exists a constant λ such that $\mu_{ij} = \lambda b_j$, $j = 1, 2$.

Risk neutrality *or* a noiseless performance measure have been sufficient conditions for achievement of the first-best result in most models examined in the principal/agent literature, but those models typically assume that the action space is either single dimensional or finite. Furthermore, many models in the literature presume that $y_1 = x$, which immediately implies that the performance measure is perfectly congruent. The key point here is that if the gross payoff to the principal is not contractible information, then risk neutrality or a noiseless performance measure are not sufficient to achieve the first-best result. The performance measure must also be perfectly congruent.

¹³ For $n > 2$, the measure of noncongruity for y_i is

$$\delta_i = \sum_{j=1}^{n-1} \sum_{k=j+1}^n [b_j \mu_{ik} - b_k \mu_{ij}]^2.$$

Figure 1
Impact of Noncongruity and Imprecision of a Single Performance Measure

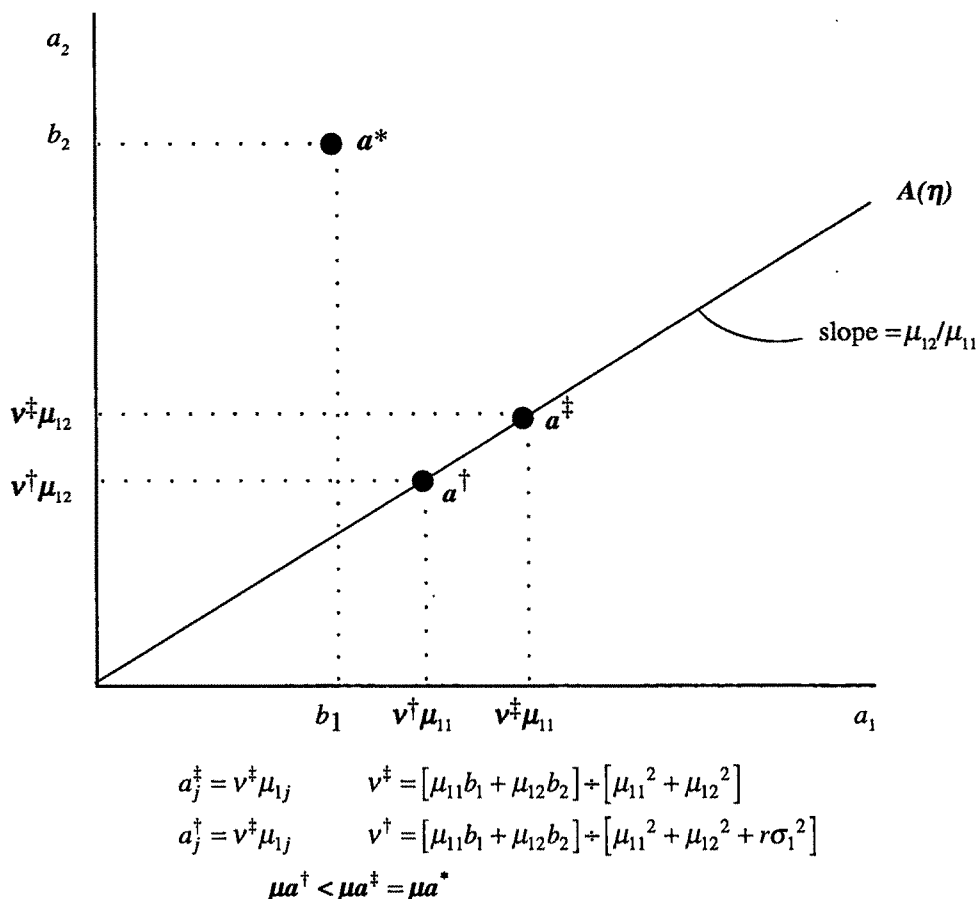


Figure 1 depicts the impact of a noncongruent, imprecise performance measure. For purposes of the illustration, assume the agent is a salesman and the two dimensions refer to the efforts for two products. The first-best action is $a^* = b$, where b_j is the expected contribution margin per unit of effort in selling product j . Assume the incremental costs are difficult to measure and the firm uses sales dollars as the performance measure. The line denoted $A(\eta)$ represents the set of actions that can be implemented with performance measurement system η ; it is the set of effort levels that minimize the agent's personal cost of providing each possible performance level (sales total) and it has a slope of μ_{12}/μ_{11} (the relative number of sales dollars per unit of sales effort for the two products). The total sales that would result if the agent selected the first-best effort is $y_1^* = \mu_{11}b_1 + \mu_{12}b_2$. Action $a^{\ddagger}$ represents the least costly action to the agent that will produce sales level y_1^* . This is the optimal second-best action if the performance measure is noiseless or the agent is risk neutral (i.e., $r\sigma_1^2 = 0$). If sales is a noisy measure (which is almost certainly the case) and the agent is risk averse, then the optimal second-best action, denoted $a^{\dagger}$, is less than but proportional to $a^{\ddagger}$. Hence, noncongruity of the performance measure causes a shift in the relative amount of effort

put into selling the two products (in this case, relatively more effort is put into selling product one than is first-best) and the imprecision of the sales measure (with risk aversion) results in weaker incentives than those that would induce the first-best performance level.

Observe that noise in a performance measure does not preclude inducement of the first-best action, it only makes it costly (because of the risk premium that must be paid). Noncongruity, on the other hand, makes it impossible to induce the first-best action. One can view much of the discussion of the trade-off between accounting and market based performance measures as a discussion of the relative merits of congruity and precision. Market based measures may be more congruent but less precise (i.e., contain more noise) than accounting measures because the former reflect information about the future consequences of current actions but are influenced by more uncontrollable events.

III. The Value of Additional Performance Measures

Table 1 illustrates the value of adding performance measures. In this section we provide a general statement of the value of additional performance measures relative to an existing set. The subsequent section considers three special cases.

Let $\eta = (\mu_1, \Sigma_{11})$ represent a performance measurement system that reports m_1 measures and let $\eta_+ = (\mu_+, \Sigma_+)$ represent a system that reports $m_+ = m_1 + m_2$ measures, where

$$\mu_+ = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix}$$

and

$$\Sigma_+ = \begin{bmatrix} \Sigma_{11} & \Sigma_{12} \\ \Sigma_{21} & \Sigma_{22} \end{bmatrix}.$$

The following proposition provides a formal specification of $\pi(\eta_+, \eta)$, the incremental expected value of the additional performance measures provided by η_+ .

Proposition 2: If $Q_+ \equiv [\mu_+ \mu_+^t + r \Sigma_+]^{-1}$ exists, then

$$\pi(\eta_+, \eta) \equiv V(\eta_+) - V(\eta) = \frac{1}{2} T^t P T \geq 0. \quad (12)$$

where $P \equiv [H_{22} - H_{21} Q H_{12}]^{-1}$ is a positive definite matrix,

$$T \equiv (\mu_2 - H_{21} Q \mu_1) b^t,$$

$$Q = [\mu_1 \mu_1^t + r \Sigma_{11}]^{-1},$$

$$\text{and } H_{ij} \equiv \mu_i \mu_j^t + r \Sigma_{ij}, \quad i, j = 1, 2.$$

Non-negativity of the incremental value of additional performance measures follows directly from the fact that the principal can always assign zero incentive to the additional measures. The positive definiteness of P and expression (12) imply that the additional measures provided by η_+ have zero value if, and only if, $T = 0$.

$$\Sigma = \begin{bmatrix} 5 & 0 & -5 \\ 0 & 25 & \frac{175}{3} \\ -5 & \frac{175}{3} & 900 \end{bmatrix}$$

The third measure is now redundant, since condition (13) holds with $\Xi = [-1 \ 7/3]$. That is, $y_3 = -y_1 + (7/3)y_2 + \text{noise}$, where $\text{noise} \sim N(0, 1460/3)$. In table 1, the third measure has incremental value because ε_3 is independent of ε_1 and ε_2 , and therefore y_3 can be used to reduce risk even though it is very noisy. However, with the above correlation structure, the optimal contract is $v^* = (.467, .158, 0)^t$; y_3 cannot be used to reduce risk and hence it is ignored (even though it is perfectly congruent with b).

IV. Special Cases of Risk Reduction and Congruity Improvement

Additional performance measures have incremental value either because they reduce the risks imposed on the agent or because they provide diverse performance measures that can be used to induce actions that are more congruent with the principal's gross payoff. We now consider some special settings that provide further insight into the two different roles of additional performance measures.

In each of the settings examined below, we consider the impact of increasing the number of performance measures from one (system η) to two (system η_+) when there are two-tasks ($n = 2$) and the agent is risk averse ($r > 0$). The two systems are characterized as follows:

$$\begin{array}{lll} \eta = (\mu, \Sigma) & \mu = [\mu_{11} \ \mu_{12}] & \Sigma = \sigma_1^2 \\ \eta_+ = (\mu_+, \Sigma_+) & \mu_+ = \begin{bmatrix} \mu_{11} & \mu_{12} \\ \mu_{21} & \mu_{22} \end{bmatrix} & \Sigma_+ = \begin{bmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{bmatrix} \end{array}$$

Information about Uncontrollable Events

Risk is created by uncontrollable events that influence performance measures. We consider a setting in which the first measure is influenced by the agent's actions, but the second is not (i.e., $\mu_{1j} > 0$ and $\mu_{2j} = 0$, for $j = 1, 2$). The second measure can be represented as $y_2 = \varepsilon_2$. It does not change the set of implementable actions and its key characteristic is its correlation with the primary measure. It has zero value if the two measures are uncorrelated ($\rho = 0$), but it has *positive value if they have some correlation* ($\rho \neq 0$). The stronger the correlation, the stronger are the incentives applied to both measures. If the two measures are perfectly correlated ($\rho = \pm 1$), then the first-best result can be achieved if the primary measure is perfectly congruent with the principal's gross payoff.

The following proposition formalizes the above discussion. Let v^* and a^* represent the optimal contract and action based on η and let v^+ and a^+ represent the optimal contract and action based on η_+ .

Proposition 4: Assume η provides a single performance measure y_1 with $\mu_{1j} > 0$, all j , and $r\sigma_1^2 > 0$. System η_+ provides both y_1 and y_2 , with $\mu_{2j} = 0$, all j .

- (a) $\pi(\eta_+, \eta) > 0$ if, and only if, $\rho \neq 0$.

(b) $L(\eta_+) = 0$ if, and only if, $\rho^2 = 1$ and $\mu_{ij} = \lambda b_j$ for some $\lambda > 0$.

$$(c) \quad v_1^\dagger = \frac{b_1\mu_{11} + b_2\mu_{21}}{\mu_{11}^2 + \mu_{12}^2 + r(1-\rho^2)\sigma_1^2} \text{ and } v_2^\dagger = -\rho \frac{\sigma_1}{\sigma_2} v_1^\dagger.$$

There are two commonly used sources of information about uncontrollable events: investigation of the factors influencing realized performance levels and the performance levels of other divisions or competitors. The use of the first type of information involves implementation of what accountants call the *controllability principle*. Antle and Demski (1988) provide a principal/agent analysis of this principle and Merchant (1987) provides some survey data on the extent of its use in practice. A basic point made by Antle and Demski is that it is not always optimal to merely eliminate the uncontrollable events from the performance measure, since the identified events may provide information about the unidentified events. This can be illustrated by assuming *uncontrollable events* (ε_1) = *identified events* (ε_2) + *unidentified events*. If the identified and unidentified events are independent, then $\rho = \sigma_2/\sigma_1$ and $v_2^\dagger = -v_1^\dagger$, i.e., the controllability principle is implemented and the contract can be viewed as paying an incentive wage $v_1^\dagger$ based on the *net performance measure* $y^\dagger \equiv y_1 - y_2$. However, if the identified and unidentified events are positively correlated, then $\rho > \sigma_2/\sigma_1$ and $-v_2^\dagger > v_1^\dagger$, i.e., a greater adjustment is made than merely eliminating the identified uncontrollable events.

The use of information from other divisions or competitors is frequently manifested in the use of *relative performance measures*. Holmstrom (1982) provides a principal/agent analysis of relative performance measures, Antle and Smith (1986) provide empirical evidence on its use based on statistical analyses of publicly reported compensation and performance data for a large number of firms, and Maher (1987) provides some survey data about the extent of its use. In our analysis, y_2 can be interpreted as the *difference between the actual and expected performance of another firm or set of firms*. If there is a positive correlation between y_1 and y_2 , then the second-best contract places a positive incentive on the agent's performance ($v_1^\dagger > 0$) and subtracts an "insurance" adjustment based on the difference between the competitor's actual and expected performance ($v_2^\dagger < 0$). An alternative interpretation is to view the contract as specifying a net performance measure $y^\dagger \equiv y_1 - (\rho\sigma_1/\sigma_2)y_2$, and an incentive wage of $v_1^\dagger y^\dagger$. Observe that the adjustment to y_1 based on y_2 depends on only the correlation between the two measures and the relative size of the noise in those two measures (as represented by the standard deviation of that noise). Interestingly, that *adjustment is independent of the congruence* of y_1 with respect to the principal's gross payoff. Of course, the congruence of y_1 does influence $v_1^\dagger$.

Myopic Performance Measures

The use of accounting earnings as the sole performance measure is often criticized because it does not fully reflect the economic consequences of the agent's actions. This myopia can arise either because the accounting measure is short-run in its orientation, ignoring the future benefits of such activities as product and personnel development, or because it focuses on a single division, ignoring externalities with respect to other divisions. While the earnings number can be modified to make it more congruent,¹⁷ such modifications are often limited by the other uses of the earnings number. Hence, the primary means for dealing with myopia have been either to supplement the

¹⁷ Magee (1978) examines a two-task setting in which the one task influences current operating profit and the other influences holding gains and losses that are realized in the future. His comparison of historical cost versus current cost income measures can be interpreted as an analysis of a single performance measure that is varied in its congruity and noise.

earnings measure with other measures that focus on future effects or externalities, or to use market price based incentives (if the firm's ownership is publicly traded). The first approach is illustrated by General Electric's use of measures of product leadership and personnel development, and by McDonald's use of quality, service and cleanliness (QSC) measures.¹⁸ Bushman and Indjejikian (1993) provide a principal/agent analysis of the second approach, assuming that the market price reflects both accounting information that may be myopic and private investor information that is perfectly congruous with the principal's gross payoff. We examine the use of market price as a performance measure in the next section.

A myopic performance measure is represented by a setting in which $b_1 = \mu_{11} > 0$ and $b_2 > \mu_{12} = 0$. The loss in surplus from using only y_1 as a performance measure is

$$L(\eta) = \frac{1}{2} \left[\frac{r\sigma_1^2}{b_1^2 + r\sigma_1^2} b_1^2 + b_2^2 \right].$$

The loss results from the costly risk imposed in motivating the first task and the failure to induce any effort in the second task. The second component of that loss can be reduced by introducing a second performance measure that independently reports on the second task,¹⁹ i.e., $\mu_{21} = 0$, $\mu_{22} = b_2$, and $\sigma_{12} = 0$. The incremental value of the second measure is

$$\pi(\eta_+, \eta) = \frac{1}{2} \left[1 - \frac{r\sigma_2^2}{b_2^2 + r\sigma_2^2} \right] b_2^2$$

and the optimal incentive contract is $v_j^* = b_j^2 / [b_j^2 + r\sigma_j^2]$, $j = 1, 2$.

The value of the second measure increases as its precision ($1/\sigma_2^2$) increases, since increased precision reduces the risk premium that must be paid and makes it optimal to use stronger incentives. If both measures are noiseless, then $v_1^* = v_2^* = 1$ and the first-best result is obtained.

Window Dressing

Performance measures, including accounting earnings, are often subject to *manipulation* in the sense that the agent can take actions that improve his performance measure but contribute little or nothing to the principal's gross payoff. We refer to this as *window dressing*, and represent it by $\mu_{11} = b_1 > 0$ and $\mu_{12} > b_2 = 0$. The loss in surplus from using only y_1 as a performance measure is

$$L(\eta) = \frac{1}{2} b_1^2 \frac{\mu_{12}^2 + r\sigma_1^2}{b_1^2 + \mu_{12}^2 + r\sigma_1^2}.$$

The loss is due to the costly risk imposed to induce positive effort in the productive act (a_1) plus the cost created by the nonproductive act (a_2). With a single performance measure, the two acts must be induced in fixed proportions: $a_1/a_2 = \mu_{11}/\mu_{12}$. Consequently, any inducement of a_1

¹⁸ McDonald's use of the QSC measure reflects the belief that the quality, service, and cleanliness of a given store has future payoff consequences both for that store and for McDonald's stores that might be frequented by the same customers.

¹⁹ We now have one performance measure for each task, which permits implementation of all possible actions. Holmstrom and Milgrom (1991) assume this to be the case in much of their analysis, and Paul (1992) assumes that this type of structure underlies the information impounded in the market price.

necessarily induces a_2 . This has two negative effects. First, to obtain contract acceptance the agent must be compensated for his personal cost of the nonproductive act. Second, because of this cost, weaker incentives are used than would be the case if $\mu_{12} = 0$, thereby inducing less productive effort.

The loss of surplus due to the nonproductive act can be reduced by introducing a second performance measure that independently reports on either the nonproductive or the productive act. If $\mu_{21} = 0$, $\mu_{22} > 0$, and $\sigma_{12} = 0$, then the incremental value of the second measure is

$$\pi(\eta_+, \eta) = \frac{1}{2} b_1^2 \frac{\mu_{12}^2 b_1^2 Q^2}{1 + r(\sigma_2 / \mu_{22})^2 - \mu_{12}^2 Q},$$

where

$$Q = [b_1^2 + \mu_{12}^2 + r\sigma_1^2]^{-1}.$$

The incremental value of y_2 increases with μ_{12} because that increases the noncongruity of the first measure and it increases with μ_{22}/σ_2 because that increases the second measure's relative precision about the nonproductive act. The optimal contract imposes a penalty on y_2 , which permits the use of stronger incentives on y_1 , thereby inducing more productive effort and less nonproductive effort. While it is feasible to eliminate all effort in the nonproductive act, it will not be optimal to do so unless the second measure is noiseless. If both measures are noiseless, then $v_1^* = 1$, $v_2^* = -\mu_{12}/\mu_{22}$, and the first-best result is obtained.

If $\mu_{21} > 0$, $\mu_{22} = 0$, and $\sigma_{12} = 0$, then the incremental value of the second measure is

$$\pi(\eta_+, \eta) = \frac{1}{2} b_1^2 \frac{[1 - b_1^2 Q]^2}{1 + r(\sigma_2 / \mu_{21})^2 - b_1^2 Q}.$$

Again, the incremental value of y_2 increases with μ_{12} because that increases the noncongruity of the first measure, and it increases with μ_{21}/σ_2 because that increases the second measure's relative precision about the productive act. Observe that the second measure is perfectly congruent with the principal's expected payoff. Hence, if it is also noiseless, the first measure is ignored ($v_1^* = 0$) and the second measure is used ($v_2^* = b_1/\mu_{21}$) to obtain the first-best result. However, if the second measure is noisy, then it is optimal to use the first measure to reduce the risk that is imposed on the agent, but that risk reduction comes at the expense of compensating the agent for the nonproductive act.

V. Market Price as a Performance Measure

In a publicly traded firm, the market price of the firm's equity at the contract termination date represents the market's expectations with respect to the equityholders' (principal) final net payoff. We now consider the impact of using that market price (adjusted for the manager's compensation) as a performance measure.

A crucial point to recognize is that the market price will reflect both *the information received by investors and their equilibrium beliefs about the agent's action*. The investors' beliefs about the agent's action are based on the incentives under which he is operating, and are not influenced by the information they receive. The investors' information will be impounded in the price to the extent that it influences their beliefs about ε_x (the uncontrollable component of x).

To illustrate these points, assume that y now represents the information received by investors prior to the contract termination date. Recall that the principal's gross payoff is $x = b'a + \varepsilon_x$, where a is the action selected by the agent and ε_x represents uncontrollable events that influence the principal's payoff (with zero mean and variance σ_x^2). Let $\Sigma_{xy} = [\sigma_{xi}]_{1 \times m}$ represent the covariance between x and y . If the investors believe the agent has selected action $\hat{a}$, then their prior belief about x and y is

$$\begin{bmatrix} x \\ y \end{bmatrix} \sim N \left(\begin{bmatrix} b'\hat{a} \\ \mu\hat{a} \end{bmatrix}, \begin{bmatrix} \sigma_x^2 & \Sigma_{xy} \\ \Sigma_{yx} & \Sigma \end{bmatrix} \right).$$

The (gross) market price at the contract termination date is equal to the investors' expectation about x conditional on y and $\hat{a}$, which is²⁰

$$p = E[x | y, \hat{a}] = b'\hat{a} + \Sigma_{xy}\Sigma^{-1}[y - \mu\hat{a}]. \quad (14)$$

From the agent's perspective, the distribution of y depends on the action he selects, i.e., $y \sim N(\mu a, \Sigma)$. Consequently, if the market price is used as a performance measure, the agent views that measure as taking the following form:

$$p = [b' - \Sigma_{xy}\Sigma^{-1}\mu] \hat{a} + \Sigma_{xy}\Sigma^{-1}\mu a + \varepsilon_p, \quad (15)$$

where $\varepsilon_p = \Sigma_{xy}\Sigma^{-1}\varepsilon \sim N(0, \sigma_p^2)$,

$$\sigma_p^2 \equiv \text{Var}[p] = \Sigma_{xy}\Sigma^{-1}\Sigma_{yx}.$$

That is, as a performance measure, the price consists of a fixed component that depends on the investors' belief about the agent's action, a component that varies with the agent's action (because of its impact on y), and a random component (due to the uncontrollable events influencing y). In equilibrium, the agent's action choice equals the investors' belief $\hat{a}$. However, the investors cannot observe a and, hence, a influences p only through its impact on y .

We now consider the impact of using the market price as the sole performance measure, instead of using the underlying information. The market price is effectively based on the following aggregate representation of the investors' information (see equation (14)):

$$y_x = \Sigma_{xy}\Sigma^{-1}y.$$

On the other hand, if y is contractible information, then the second-best incentive contract is effectively based on the following aggregate representation of the agent's performance measures (see equation (7)):

$$y_a = [Q\mu b]y$$

where

$$Q = [\mu\mu' + r\Sigma]^{-1}.$$

The market price can be used as the sole performance measure, without any loss of surplus, if the signal weights in y_x are proportional to those in y_a .

²⁰ See Raiffa and Schlaifer (1961) for derivation of the conditional mean from a joint normal distribution.

Proposition 5: Assume y is publicly reported, $r > 0$, and Σ is positive definite. There is no loss in surplus from using the market price as the sole performance measure, instead of using y , if, and only if,

$$\Sigma_{xy} \Sigma^{-1} = \lambda [Q\mu b]^t \quad \text{for some } \lambda \neq 0. \quad (16)$$

To provide insight into condition (16), we consider some simple two-task settings with one and two public signals. With one signal

$$\Sigma = \sigma_1^2 \quad \Sigma_{xy} = \sigma_{x1},$$

and with two signals

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{bmatrix} \quad \Sigma_{xy} = \begin{bmatrix} \sigma_{x1} & \sigma_{x2} \end{bmatrix}.$$

Corollary: Assume y is publicly reported and $r\sigma_i > 0$, all i .

(a) Suppose $m = 1$ and $\mu_{ij} > 0$, all j . There is no loss in surplus from using p as the sole performance measure if, and only if, $\sigma_{x1} \neq 0$.

(b) Suppose $m = 2$, and $\mu_{ij} > 0$, $\mu_{2j} = 0$, all j . There is no loss in surplus from using p as the sole performance measure if, and only if, $\sigma_{x1} \neq 0$ and $\sigma_{x2} = 0$.

(c) Suppose $m = 2$, $\mu_{ij} = b_j$ all j , $\mu_{ij} = 0$ all $i \neq j$, and $\rho = 0$. There is no loss in surplus from using p as the sole performance measure if, and only if,

$$\frac{\sigma_{xi}}{\sigma_i^2} = \lambda \frac{b_i^2}{b_i^2 + r\sigma_i^2} \quad \text{for all } i \text{ and some } \lambda \neq 0. \quad (17)$$

In case (a) there is a single public report, such as accounting earnings. The corollary states that p and y_1 are equivalent performance measures if y_1 provides investors with information about the *uncontrollable events* influencing the terminal value of the firm. With a single signal, the congruity of that signal is immaterial. Observe that p has no value as a performance measure if y_1 is a noisy measure of a and the noise is due to measurement error that tells investors nothing about ε_x . In that setting it is important to use y_1 , and not p , as the performance measure.

Case (b) is similar to the risk reduction example in the preceding section. Signal y_1 can be interpreted as accounting earnings, which is influenced by the agent's actions, and y_2 can be interpreted as information about uncontrollable events that influence x and/or y_1 . Again, p and y_1 are interchangeable performance measures if y_1 provides investors with information about the uncontrollable events influencing the terminal value of the firm. The key issue is whether y_2 can be ignored if p is used as the performance measure. Somewhat surprisingly, the answer is yes if, and only if, y_2 provides information about the uncontrollable events influencing y_1 but provides *no direct information about the uncontrollable events influencing x* , e.g., y_2 reports measurement errors in y_1 . Observe that if $\sigma_{x2} = 0$, then y_2 provides information about the *noise* in y_1 and that

information is used in the same way for both evaluating performance and predicting the value of the firm: $y_a \propto y_x \propto y_1 - (\rho\sigma_1/\sigma_2)y_2$.²¹ If $\sigma_{x2} \neq 0$, then y_2 provides direct information about the x . This information improves the relation between p and x , but it creates additional noise in the relation between a and p . This is seen most clearly in the setting in which $\rho = 0$ and $\sigma_{x2} \neq 0$. In this setting, y_2 provides information about uncontrollable events that affect x but not y_1 , e.g., information about market-wide events that will influence the terminal value of the firm but have not influenced current accounting earnings. Hence, y_2 is ignored in the optimal incentive contract ($y_a \propto y_1$), but it influences the price ($y_x \propto (\sigma_{x1}/\sigma_1^2)y_1 + (\sigma_{x2}/\sigma_2^2)y_2$). Hence, p is a *strictly noisier* performance measure than y_1 . Of course, p can be used to obtain the same surplus as y_1 if both p and y_2 are used. Observe that the above results are independent of the congruity of the first signal.

In case (c) there are two independent signals—one for each task. Paul (1992) explores this type of setting. He interprets it as representative of a firm in which the agent manages several divisions and publicly reports information about the profitability of each division.²² Since the scaling of a signal is arbitrary, we assume that each signal is scaled so that $\mu_{ji} = b_j$. An efficient aggregate performance measure uses divisional weights that reflect the noise in each signal and the rate at which the agent's effort generates value in each division ($y_a = y_1 b_1^2/(b_1^2 + r\sigma_1^2) + y_2 b_2^2/(b_2^2 + r\sigma_2^2)$). Price, on the other hand, uses weights that reflect only the relation between the noise in the divisional signal and the payoff that will ultimately be generated by that division ($y_p = y_1 \sigma_{x1}/\sigma_1^2 + y_2 \sigma_{x2}/\sigma_2^2$). Other than a setting in which the two tasks are equivalent (i.e., $b_1 = b_2$, $\sigma_1 = \sigma_2$, and $\sigma_{x1} = \sigma_{x2}$), there do not appear to be any contexts in which condition (17) is satisfied (other than by coincidence). For example, assume the signals report the terminal value generated by each task (i.e., $x = y_1 + y_2$). In that setting, $\sigma_{xi} = \sigma_i^2$ and condition (17) holds if, and only if, $b_1/b_2 = \sigma_1/\sigma_2$. That is, the relative noise in the two signals must equal the relative value generated by the two tasks.

The preceding discussion suggests that if there are multiple tasks and multiple public signals that are influenced by the agent's action, then it is unlikely that the market price provides an efficient single performance measure, even though it provides an efficient prediction of the firm's future value.²³ Nonetheless, we find extensive use of market price as a performance measure, in that managers often hold stock, or stock options, in their own firm. There are two potential explanations for the use of price as a performance measure. First, the price may impound investor information that is not publicly reported but is useful in evaluating the agent's performance. For example, Bushman and Indjejikian (1993) provide a rational expectations model in which price impounds private investor information and a public report (e.g., an earnings report).²⁴ The optimal incentive contract is based on both the market price and the public report. Second, while the price

²¹ "∝" denotes "proportional to," i.e., the term on the left is equal to the term on the right times some constant. In this setting,

$$\begin{aligned} \Sigma_{xy} \Sigma^{-1} &= \begin{bmatrix} \mathbf{v}_x & \rho \frac{\sigma_1}{\sigma_2} \mathbf{v}_x \end{bmatrix} & \mathbf{v}_x &= \frac{\sigma_{x1}}{\sigma_1^2(1-\rho^2)} \\ b^i \mu^i Q &= \begin{bmatrix} \mathbf{v}_a & \rho \frac{\sigma_1}{\sigma_2} \mathbf{n}_a \end{bmatrix} & \mathbf{v}_a &= \frac{b_1 \mu_{11} + b_2 \mu_{12}}{\mu_{11}^2 + \mu_{12}^2 + r(1-\rho^2)\sigma_1^2} \end{aligned}$$

²² Paul (1991) considers two actions and interprets them as pertaining to short and long run cash flows. He demonstrates that overemphasis on either short run or long run actions can occur, depending upon which type of information has the most pronounced effect on price.

²³ Paul (1991, 1992) also emphasizes this point. Dye (1985) makes a similar point in the context of discussing the potential impact of disclosure of payoff information received by the agent after he has taken his action. Gjesdal (1981) demonstrates that the optimal aggregation of information in valuation decisions is likely to differ from the optimal aggregation used in performance evaluation.

²⁴ In Bushman and Indjejikian (1993) the investors receive private information that is equal to x plus noise. The in-

may not be a perfect aggregate performance measure, it is readily observed and may provide a cost-effective aggregate measure when contracting costs are taken into consideration.

Interestingly, price is *not* necessarily, nor even likely to be, a perfectly congruent performance measure. Examination of pricing relation (15) reveals that while $b'\hat{a}$ is an important ingredient in the price, the congruity of the price as a performance measure depends on $\sum_x \sum_y \mu$ and this may not be proportional to b . The congruity of the price depends on the congruity and diversity of the information received by investors and the weights they give that information in their prediction of x .

VI. Concluding Remarks

Our analysis has examined the role of multiple performance measures in influencing the direction and intensity of an agent's effort. A perfectly congruent performance measure will induce the first-best direction, but it will not be used to induce the first-best intensity unless it is noiseless. Noisy performance measures create risk, and the agent must be compensated for that risk. The stronger the incentives used, the larger the risk premium that must be paid. Hence, noise weakens the incentives that are used. If the basic measure is perfectly congruent, then the primary role for additional performance measures is to reduce the risk that must be imposed on the agent. However, the use of noncongruent performance measures would produce a second-best action that differs from the first-best action in both direction and intensity.

A single noiseless performance measure cannot be used to achieve the first-best result unless it is perfectly congruent. The direction induced by a single noncongruent measure can be improved by using a set of diverse performance measures. The first-best result can be achieved with multiple noiseless performance measures if they span the first-best direction. Of course, if the additional measures are noisy, then the second-best action may differ from the first-best action in both direction and intensity (even though the first-best action is feasible).

The market price at the contract termination date is a potentially useful performance measure, either as a replacement for some other measure or because it is influenced by noncontractible information. The market price reflects investor beliefs at the trading date and those beliefs are influenced by the information they receive. In particular, the price reflects the investors' equilibrium beliefs about the actions taken by the manager and the information they have about the uncontrollable events that will influence the terminal value of the firm. The investors are not concerned with incentives when they use their information to set the price, and hence price is not likely to be an efficient aggregate performance measure. That is, the relative weighting given to signals in the price need not equal the weightings those signals would be given in the second-best incentive contract. Barring exceptional circumstances, a second-best incentive contract requires that the price be supplemented with other measures, even though those measures are impounded in the price.

vestors also receive an accounting report, which may take one of two forms. In the first case, the accounting report also equals x plus noise, which implies that the price (which impounds both types of information) is perfectly congruent with the principal's gross payoff. In the second case, the accounting report equals the payoff generated by the effort in one task, plus noise. Since the first measure is perfectly congruent and the second is not, the price is not perfectly congruent with the principal's gross payoff.

Appendix A Proofs

Q.E.D.

Proposition 1:

Sufficiency: $\mu_1 = \lambda b'$ implies that $\delta_1 = 0$. $\lambda \neq 0$ implies that Q is finite, even if $r\sigma_1^2 = 0$. Hence, $L(\eta) = 0$ for the stated conditions, follows directly from equation (11).

Necessity: All terms in the numerator and denominator are nonnegative. Hence, zero loss only occurs if both δ_1 and $r\sigma_1^2 b'b$ equal zero. $\delta_1 = 0$ implies $b_1/b_2 = \mu_{11}/\mu_{12}$, which implies the existence of λ such that $\mu_{1j} = \lambda b_j$. Since $b'b > 0$, $r\sigma_1^2 b'b = 0$ only if $r\sigma_1^2 = 0$. Q.E.D.

Proposition 2:

From equation (9), $V(\eta_+) - V(\eta) = \frac{1}{2}b[D_+ - D]b'$,

where $D_+ = \mu_+ Q_+ \mu_+$

and $Q_+ = [\mu_+ \mu_+^t + r\Sigma_+]^{-1}$.

Observe that $H \equiv \mu_+ \mu_+^t + r\Sigma_+ = \begin{bmatrix} H_{11} & H_{12} \\ H_{21} & H_{22} \end{bmatrix}$.

It then follows that

$$Q_+ = \begin{bmatrix} Q + QH_{12}PH_{21}Q & -QH_{12}P \\ -PH_{21}Q & P \end{bmatrix},$$

which in turn implies

$$D_+ = \mu'Q\mu + \mu'QH_{12}PH_{21}Q\mu - \mu_2'PH_{21}Q\mu - \mu'QH_{12}P\mu_2 + \mu_2'P\mu_2.$$

Therefore, $b'[D_+ - D]b = b'(\mu_2 - H_{21}Q\mu)'P(\mu_2 - H_{21}Q\mu)b = T'PT$.

To prove that P is positive definite, we first observe that both $\mu_+ \mu_+^t$ and Σ_+ are both positive semidefinite (and Σ_+ is positive definite if there are no noiseless performance measures). With $r \geq 0$, it then follows that H is positive semidefinite. Since $Q_+ = H^{-1}$ is assumed to exist, it follows that both H and H^{-1} are positive definite. Finally, the fact that H^{-1} is positive definite implies that $P = H_{22} - H_{21}H_{11}^{-1}H_{12}$ is positive definite. Q.E.D.

Lemma 1:

In general, $f(y_1, y_2 | a) = g(y_2 | y_1, a)h(y_1 | a)$, where g is the conditional density for y_2 given y_1 and a , and h is the marginal density function for y_1 given a . Sufficiency is satisfied by showing that condition (13) implies the conditional mean is independent of a (this parameter has no impact on the variance):

$$E[y_2 | y_1, a] = \mu_2 a + \sum_{21} \sum_{11}^{-1} [y_1 - \mu_1 a] = \Xi (\mu_1 a + \sum_{21} \sum_{11}^{-1} [y_1 - \mu_1 a]) = \Xi y_1.$$

See Raiffa and Schlaifer (1961) for a general derivation of the conditional mean and variance for normal distributions. **Q.E.D.**

Proposition 3:

$\pi(\eta_+, \eta) = 0$ if, and only if, $T = 0$. The sufficiency of the conditions follows from

$$\begin{aligned} T &= (\mu_2 - H_{21}Q\mu)b \\ &= (\Xi M - (\Xi\mu\mu^t + r\Xi\Sigma)Q\mu)b \\ &= \Xi(\mu - (\mu\mu^t + r\Sigma)Q\mu)b = 0. \end{aligned}$$

The necessity of the conditions is demonstrated as follows.

$$\begin{aligned} T = 0 &\Rightarrow \mu_2 - \mu_2\mu^tQ\mu = r\Sigma_{21}Q\mu, \\ &\Rightarrow \mu_2 = r\Sigma_{21}Q\mu[I - \mu^tQ\mu]^{-1} = r\Sigma_{21}Q\mu[I + \mu^t(r\Sigma)^{-1}\mu] = r\Sigma_{21}Q[I + \mu\mu^t(r\Sigma)^{-1}]\mu. \end{aligned}$$

$$\text{Let } \Xi = r\Sigma_{21}Q[I + \mu\mu^t(r\Sigma)^{-1}].$$

Hence, $\Xi\mu = \mu_2$ follows directly and

$$\Xi\Sigma = r\Sigma_{21}Q[I + \mu\mu^t(r\Sigma)^{-1}]\Sigma = \Sigma_{21}Q[r\Sigma + \mu\mu^t] = \Sigma_{21}. \quad \text{Q.E.D.}$$

Proposition 4:

If $\mu_{11} > 0$, $\mu_{12} > 0$, and $\mu_{21} = \mu_{22} = 0$, then $\pi(\eta_+, \eta) = \frac{1}{2} T^2 P$,

$$\text{where } P = [\Delta Q]^{-1},$$

$$T = -r\rho\sigma_1\sigma_2Q\mu b,$$

$$Q = [\mu\mu^t + r\sigma_1^2]^{-1},$$

$$\Delta = r\sigma_2^2[\mu\mu^t + r\sigma_1^2(1-\rho^2)].$$

(i) If $r\sigma_1 > 0$ and $\mu > 0$, then $P > 0$ and $T = 0$ if, and only if, $\rho = 0$ (note: $\sigma_2 = 0 \Rightarrow \rho = 0$).

$$(ii) L(\eta_+) = \frac{1}{2} \frac{r\sigma_2^2}{\Delta} [r\sigma_1^2(1-\rho^2)bb^t + \delta_1].$$

Hence, $L = 0$ if, and only if $\rho^2 = 1$ and $\delta_1 = 0$ (which requires $\mu = \lambda b$ for some λ).

$$(iii) v^t = Q_+\mu_+b = \frac{r}{\Delta} \mu b \begin{bmatrix} \sigma_2^2 \\ -\rho\sigma_1\sigma_2 \end{bmatrix}.$$

Proposition 5:

Observe that an incentive contract v_p that is based solely on p can be replicated by a contract based on y by letting $v^* = v_p \sum_{xy} \sum^{-1}$. Since $v^* = Q\mu b$ is the unique optimal contract based on y , it follows that the incentive contract based on p produces the same payoff to the principal as v^* if, and only if, $v^{*t} = v_p^t \sum_{xy} \sum^{-1}$. The stated condition then holds with $\lambda = 1/v_p$ **Q.E.D.**

Appendix B**Minimum Cost Contracts for the Set of Implementable Actions**

Grossman and Hart [GH] (1983) use a two step approach to solve the principal's problem in a standard agency problem. They first determine the minimum cost incentive contract for inducing each action $a \in A$, and then they identify the action for which the difference between the expected benefit and the expected compensation cost is maximized. The GH approach can be adapted to our setting, but it must be modified because in a multi-task setting it may not be possible to induce all actions. For example, in figure 1 only the actions on the line denote $A(\eta)$ are implementable. With multiple performance measures, the set of implementable actions is

$$A(\eta) \equiv \{ a \mid \text{for some } v_1, \dots, v_m, a_j = \sum_{i=1}^m v_i \mu_{ij} \text{ for all } a_j > 0, \text{ and } \sum_{i=1}^m v_i \mu_{ij} \leq 0 \text{ for all } a_j = 0 \}.$$

An interior action (i.e., $a_j > 0$ all j) is implementable if it is *spanned* by the set of performance measure coefficients. This can be interpreted as a setting in which there exist performance measure weights such that an *aggregate measure* can be formed that is perfectly congruent with the desired action. The following is a formal statement of this spanning condition.

Lemma B.1:

(a) Interior action $a \in A(\eta)$ if, and only if, $\text{rank}(\mu) = \text{rank}(M(a))$, where $M(a) \equiv [\mu^t a]^t$.

(b) If Σ is positive definite, $\text{rank}(\mu^t \Sigma \mu) = \text{rank}(\mu)$. Hence, $\mu^t \Sigma \mu$ is non-singular if $\text{rank}(\mu) = n$.

Proof:

(a) This follows from the requirements for a solution to a system of linear equations.

(b) Since Σ is positive definite, there exists a non-singular $m \times m$ matrix N such that $\Sigma = N^t N$ and $\text{rank}(N) = m$. From the rank preservation theorem (Ortega, 1987, 61), $\text{rank}(\mu^t N^t) = \text{rank}(N \mu) = \text{rank}(\mu)$. Furthermore, $\text{rank}(\mu^t N^t N \mu) = \text{rank}(N \mu)$ (Ortega, 1987, 63).

For any implementable action a there may be one or more incentive contracts that can be used to induce that action. If the performance measures are noiseless ($\Sigma = 0$) or the agent is risk neutral ($r = 0$), then the choice among the feasible incentive contracts is immaterial (assuming β is selected so that the contract pays the agent $C(a) + w^0$). Furthermore, if the performance measures are noiseless and the first-best action is implementable, then the first-best result can be achieved with either a linear incentive contract or a penalty contract.

Proposition B.1: Assume $\Sigma = 0$ and $a^* = b \in A(\eta)$. The first-best result can be achieved with either

(a) any linear contract (β, v) such that $\mu^t v = b$ and $\beta = C(b) + w^0 - v^t \mu b$, or

(b) a penalty contract in which $w(y) = C(b) + w^0$ if $y = y^* \equiv \mu b$, and zero otherwise.

Proof:

- (a) Lemma B.1(a) establishes that $b \in A(\eta)$ implies the existence of a vector v such that $\mu'v = b$. It follows from first order condition (8) that the agent chooses $a = \mu'v = b'$.
- (b) Given the penalty contract, the agent chooses $a \in A^*(y^*) \equiv \arg \min C(a)$ subject to $y^* = \mu a$. The first-order conditions for the agent's problem establish that the agent chooses $a = \mu'v$, where v is an $m \times 1$ vector of Lagrange multipliers for the m performance level constraints. The definition of y^* implies that a^* satisfies the performance level constraints, and the existence of the desired Lagrange multipliers follows from the implementability of a^* and Lemma B.1. Q.E.D.

Approach (a) can also be used if the agent is risk neutral, if the performance measures are noisy. Approach (b) is the multi-task equivalent of the penalty contract used when there is moving support in the single-dimensional action case. The key here is that either congruent or multiple performance measures are required to implement an effective penalty contract when a variety of effort combinations can be used to attain a given performance level. The first-best action must be the *least cost action* for implementing the specified performance levels.

If the performance measures are noisy and the agent is risk averse, then the least cost contract is the feasible contract that minimizes the risk imposed on the agent. The following proposition identifies the optimal contract to implement action a when Σ is positive definite and there are an infinite number of contracts that can be used to induce a . (From Lemma (B.1), $a \in A(\eta)$ if, and only if, $\text{rank}(M(a)) = \text{rank}(\mu)$, where $M(a) = [\mu' a]'$. If this condition holds, there is at least one incentive contract v that induces a . The least cost contract can be expressed as a closed form solution if $\text{rank}(\mu) = n$, but not if $\text{rank}(\mu) < n$.)

Proposition B.2: Assume Σ is positive definite and consider implementable, interior action a .

- (a) If $\text{rank}(\mu) = m$, then there is a unique contract for implementing a and, if $\text{rank}(\mu) = n$, that contract is:

$$v = [\mu']^{-1}a. \quad (\text{B.1})$$

- (b) If $\text{rank}(\mu) < m$, then there are an infinite number of contracts that can be used to induce a and, if $\text{rank}(\mu) = n$, the least cost contract is:

$$v = \Sigma^{-1}\mu[\mu'\Sigma^{-1}\mu]^{-1}a. \quad (\text{B.2})$$

Proof:

Lemma B.1(a) establishes that the implementability of a implies $\text{rank}(\mu) = \text{rank}(M(a))$.

- (a) If $\text{rank}(\mu) = \text{rank}(M(a)) = m \leq n$, then it is well known that there is a unique solution to the system of n equations in m unknowns. If $m = n$, then μ^{-1} exists and equation (B.1) is obtained from condition (8).

- (b) If $\text{rank}(\mu) = \text{rank}(M(a)) < m$, then there are only $\text{rank}(\mu)$ independent equations for m unknowns and $m - \text{rank}(\mu) > 0$ variables can be chosen arbitrarily. Hence, there exist

infinitely many incentive contracts that can implement a . The one that minimizes $v' \Sigma v$ can be obtained by solving the following problem:

$$\min_v \quad v' \Sigma v \quad \text{subject to } \mu' v = a. \quad (\text{B.3})$$

The Lagrangian for this problem is

$$v' \Sigma v - \Lambda' (\mu' v - a),$$

where Λ is an $n \times 1$ vector of Lagrange multipliers. The first-order condition is

$$2 \Sigma v = \mu \Lambda \Leftrightarrow v = \frac{1}{2} \Sigma^{-1} \mu \Lambda. \quad (\text{B.4})$$

If $\text{rank}(\mu) = n$, then $\mu' \Sigma^{-1} \mu$ is non-singular (see Lemma B.1(b)) and we can solve for Λ by substituting v into condition (B.3) to get

$$\frac{1}{2} \mu' \Sigma^{-1} \mu \Lambda = a \Leftrightarrow \Lambda = 2 [\mu' \Sigma^{-1} \mu]^{-1} a.$$

Substituting for Λ in (B.4) provides expression (B.2).

Q.E.D.

To illustrate the above result, consider the two-task example in table 1. The single performance measure case is the same as in figure 1; the first performance measure cannot be used to implement the first-best action. With two noncongruent performance measures, there is a unique contract for implementing each action, including the first-best action. While the first-best action can be implemented in this setting, the second-best contract implements a different action. This arises from the tradeoff between the loss from noncongruent actions and the cost of risk. With three noncongruent performance measures there are an infinite number of contracts that can implement any action. The least cost contract minimizes the risk imposed on the agent. Hence, even though the third measure is perfectly congruent with the first-best action, it is given little weight because it is very noisy. Again, risk considerations result in a second-best action that differs from the first-best action.

References

- Amershi, A. H. 1988. Blackwell informativeness and sufficient statistics with applications to financial markets and multiperson agencies. In *Economic Analysis of Information and Contracts*, edited by G. A. Feltham, A. H. Amershi, and W. T. Ziemba. Boston: Kluwer Academic Publishers, 25–91.
- , R. D. Banker, and S. M. Datar. 1990. Economic sufficiency and statistical sufficiency in the aggregation of accounting signals. *The Accounting Review* 65 (January): 113–130.
- , and J. S. Hughes. 1989. Multiple signals, statistical sufficiency, and Pareto orderings of best agency contracts. *RAND Journal of Economics* 20 (Spring): 102–112.
- Anthony, R. N., J. Dearden, and V. Govindarajan. 1992. *Management Control Systems*, Seventh Edition. Boston: Irwin.
- Antle, R., and J. S. Demski. 1988. The controllability principle in responsibility accounting. *The Accounting Review* 62 (October): 700–718.
- , and A. Smith. 1986. An empirical investigation of the relative performance evaluation of corporate executives. *Journal of Accounting Research* 24 (Spring): 1–39.
- Baiman, S., and J. Noel. 1985. Noncontrollable costs and responsibility accounting. *Journal of Accounting Research* 23 (Autumn): 486–501.

- Banker, R. D., and S. M. Datar. 1989. Sensitivity, precision, and linear aggregation of signals for performance evaluation. *Journal of Accounting Research* 27 (Spring): 21–39.
- Bushman, R. M. and R. J. Indjejikian. 1993. Accounting income, stock price and managerial compensation. *Journal of Accounting and Economics* 16 (January/April/July): 3–23.
- Dye, R. A. 1985. Disclosure of nonproprietary information. *Journal of Accounting Research* 23 (Spring): 123–145.
- . 1988. Earnings management in an overlapping generations model. *Journal of Accounting Research* 26 (Autumn): 195–235.
- Gjesdal, F. 1981. Accounting for stewardship. *Journal of Accounting Research* 19 (Spring): 208–231.
- . 1982. Information and incentives: The agency information problem. *Review of Economic Studies* (July): 373–390.
- Grossman, S., and O. D. Hart. 1983. An analysis of the principal-agent problem. *Econometrica* 51 (January): 7–45.
- Holmstrom, B. 1979. Moral hazard and Observability. *Bell Journal of Economics* 10 (Spring): 74–91.
- . 1982. Moral hazard in teams. *Bell Journal of Economics* 13 (Autumn): 324–340.
- , and P. Milgrom. 1987. Aggregation and linearity in the provision of intertemporal incentives. *Econometrica* 55: 303–328.
- , and ———. 1991. Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design. *Journal of Law, Economics and Organizations* 7: 24–52.
- Horngren, C. T., and G. Foster. 1991. *Cost Accounting: A Managerial Emphasis*, Seventh Edition. Englewood Cliffs, New Jersey: Prentice Hall.
- Kanodia, C., R. Bushman, and J. Dickhaut. 1989. Escalation errors and sunk cost effect: An explanation based on reputation and information asymmetries. *Journal of Accounting Research* 27 (Spring): 59–77.
- Kaplan, R., and A. A. Atkinson. 1989. *Advanced Management Accounting*, Second Edition. Englewood Cliffs, New Jersey: Prentice Hall.
- Magee, R. P. 1978. Accounting measurement and employment contracts: Current value reporting. *Bell Journal of Economics* 9 (Spring): 145–158.
- . 1986. *Advanced Managerial Accounting*. New York: Harper and Row.
- Maher, M. W. 1987. The use of relative performance evaluation in organizations. In *Accounting and Management: Field Study Perspectives*, edited by W. J. Bruns, Jr. and R. S. Kaplan. Boston: Harvard Business School Press, 295–315.
- Matsumura, E. M. 1988. Sequential choice under moral hazard. In *Economic Analysis of Information and Contracts*, edited by G. A. Feltham, A. H. Amershi, and W. T. Ziemba. Boston: Kluwer Academic Publishers, 221–245.
- Merchant, K. A. 1987. How and why firms disregard the controllability principle. In *Accounting and Management: Field Study Perspectives*, edited by W. J. Bruns, Jr. and R. S. Kaplan. Boston: Harvard Business School Press, 316–338.
- Ortega, J. M. 1987. *Matrix Theory: A Second Course*. New York: Plenum Press.
- Paul, J. M. 1991. Managerial myopia and the observability of future cash flows. Working Paper, University of Michigan, Ann Arbor, Michigan.
- . 1992. On the efficiency of stock-based compensation. *Review of Financial Studies* 5: 471–502.
- Raiffa, H., and R. Schlaifer. 1961. *Applied Statistical Decision Theory*. Boston: Graduate School of Business, Harvard University.

The Nature of Information in Commercial Bank Loan Loss Disclosures

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SYNOPSIS AND INTRODUCTION: Commercial bank loan portfolios are typically 10 to 15 times larger than bank equity; therefore bank loan portfolio cash flows and default risks are likely to have an important impact on bank stock market values. Bank financial statements provide three separate disclosures of changing default risks: non-performing loans, loan loss provisions, and loan chargeoffs. This study analyzes each of these disclosures for information about future bank cash flows and examines how investors impound this information in bank stock prices.

Non-performing loans include all loans in the portfolio more than 90 days overdue on interest or principal payments, and are disclosed as supplemental financial statement information. Loan loss provisions reflect the current period increase in the level of expected future loan losses, and are disclosed as accrued expenses on the income statement. Loan chargeoffs measure all loans deemed uncollectible during the period. Chargeoffs are asset writeoffs that are reported separately in financial statement footnotes, and can also be derived from balance sheet and income statement data. Together these three disclosures represent an integrated, contextual set of potentially value-relevant information spanning the income statement, balance sheet, and footnotes.

Recent empirical studies obtain evidence consistent with a *positive* relation between stock returns and loan loss provisions (cf., Beaver et al. 1989; Elliott et al. 1991; Griffin and Wallach 1991; Johnson 1989). This evidence is surprising because it contradicts the notion that loan loss provisions are interpreted as expenses that

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reflect expected future loan losses. These papers conjecture that perhaps the market interprets provisions as revelations of bank managers' private information about expected future earnings, but do not test this idea.

One potential explanation for these findings is that investors condition their interpretation of unexpected provisions on contemporaneous unexpected changes in non-performing loans and unexpected loan chargeoffs. These relatively non-discretionary pieces of loan loss information may enable investors to estimate discretionary components in unexpected loan loss provisions. If investors observe discretion being exercised over reported provisions, then they can make inferences about managers' private information. The conjecture of prior research is that investors infer that managers reveal "good news" when they exercise discretion to increase provisions.

The evidence presented here suggests bank managers increase the discretionary component of unexpected loan loss provisions when future cash flow prospects improve. Specifically, unexpected provisions are positively related to future changes in cash flows, after controlling for current changes in cash flows, unexpected changes in non-performing loans, and unexpected loan chargeoffs. Annual unexpected provisions are positively related to future changes in cash flows as far as three years ahead. Contemporaneous annual (and quarterly) stock returns, as well as earnings announcement date stock price reactions, confirm that investors interpret discretionary components of unexpected provisions as "good news." These findings contribute new evidence on earnings management and its impact on the capital markets.

The positive relations between unexpected provisions and both returns and future cash flows emerge only when unexpected provisions are conditioned on unexpected changes in non-performing loans and unexpected loan chargeoffs. These results suggest unexpected changes in non-performing loans and unexpected loan chargeoffs, both of which are negatively related to changes in future cash flows and current stock returns, and enable investors to observe discretionary components of unexpected provisions. These findings provide new evidence of a context in which the market's interpretation of a component of income is conditioned on related disclosures found on the balance sheet and in the financial statement footnotes.

Key Words: *Banks, Loan loss provisions, Non-performing loans, Loan chargeoffs.*

Data Availability: *The data are available from public sources. A list of sample banks is available from the author.*

THE remainder of the paper is organized into eight sections. The next section provides a brief description of loan loss accounting practice. Section II discusses the hypotheses of this study. Section III describes the data and section IV presents estimates of expectations models for each of the three loan loss disclosures. Section V provides a set of cash flow prediction tests using unexpected loan loss information. Section VI presents tests of returns associated with unexpected loan loss information, and section VII examines stock price behavior around the release of the loan loss disclosures. Section VIII concludes.

I. Commercial Bank Loan Loss Accounting

Accounting principles for commercial bank loan losses (primarily FAS 5 and FAS 15) adopt a balance sheet-based principal recovery perspective. Outstanding loan balances are valued at the historical cost of outstanding loan principal. Loan loss allowances (contra-assets) are to be maintained at levels considered adequate to reflect management's expectations of future losses of loan principal for the whole portfolio.

Non-Performing Loans

SEC Guide 3 (August, 1976) requires banks to provide supplemental disclosures of non-performing loans, which include the total principal outstanding in three categories of loans: non-accrual, past due, and troubled debt restructurings. Non-accrual and past due loans comprise all loans with principal or interest payments at least 90 days overdue. Non-accrual loans, typically the majority of non-performing loans, are considered by managers to be more likely to default and are accounted for on the cash basis. Loan loss provisions are recorded if non-accrual or past due loans appear likely to default. As set forth in FAS 15, a loan is considered a troubled debt restructuring "if the creditor for economic or legal reasons related to the debtor's financial difficulties grants a concession to the debtor that it would not otherwise consider." If the undiscounted sum of the renegotiated future cash flows is less than the outstanding principal then the difference is recognized as a loan loss provision and chargeoff in the period of restructuring.

Non-performing loans result from circumstances largely exogenous to the bank manager's reporting decisions and involve relatively mechanical classification procedures. Thus, managers have limited discretionary ability to change the level of non-performing loans.

Loan Loss Provisions

If losses of principal appear probable and reasonably estimable, then loan loss provisions are recorded to increase the loan loss allowance and reduce current income (per FAS 5). Bank managers have private information regarding default risks inherent in the loan portfolio; therefore their judgment is necessary in estimating the loan loss provision each period. It is prohibitively costly for investors and monitors to obtain all of management's information about the loan portfolio each period. Thus, bank managers can exercise discretion over the timing of provisions for certain loan losses.

During this study period, banks were required by federal and state bank regulators to maintain minimum capital ratios (typically 5-6 percent of gross total assets). Bank primary capital ratios were calculated as stockholders equity plus the loan loss allowance over gross total assets.¹ Each dollar of loan loss provision increased the allowance by a dollar and reduced retained earnings by a dollar minus the associated tax savings. The net effect was that regulatory capital increased by the accrued amount of tax savings from provisions.² Moyer (1990) provides evidence consistent with bank managers exercising discretion over the timing of reported loan loss provisions to avoid regulatory capital constraints.³

¹Risk-weighted capital standards, based on the July 1988 Basle Accord, were adopted by U.S. bank regulators in 1989. These new standards are to be enforced as of year-end 1992, with interim guidelines in effect beginning with year-end 1990. Under these new requirements, the loan loss allowance is not included in the numerator of the Tier I capital ratio, but is included in the Tier II ratio, up to a certain limit.

²Loan loss deductions for tax purposes are determined separately from provisions for book purposes. Book provisions often exceeded tax loan loss deductions during this sample period, reducing book-tax income differences for alternative minimum tax purposes. These effects are assumed to be minimal for the purposes of this study.

³Other studies also document that capital impacts loan loss provisions (cf., Scholes et al. 1990; Collins et al. 1993; and Beatty et al. 1993).

Loan Chargeoffs

Specific loans are charged off when they are deemed uncollectible. Loans outstanding and the loan loss allowance are reduced by the amount of principal lost, net of any expected recovery. Exogenous factors (e.g., actions by federal bank regulators and bankruptcy proceedings) determine certain loan chargeoffs. Also, according to some banks' policies, consumer loans are automatically charged off when they become a certain number of days delinquent. Thus, chargeoffs are considered relatively non-discretionary. The timing and magnitude of some commercial loan chargeoffs, however, may involve a degree of management judgment to determine when the loan loss is considered realized and to estimate the extent of expected recoveries.⁴

II. Hypotheses

The key question of this study is: what do investors learn from unexpected changes in non-performing loans, loan loss provisions, and loan chargeoffs? Unexpected changes in non-performing loans are relatively non-discretionary leading indicators of expected future loan losses. Unexpected chargeoffs are relatively non-discretionary realizations of loan losses. Both are hypothesized to be negatively related to bank stock returns and changes in future cash flows.

Because accounting for loan loss provisions requires management judgment, investors are likely to interpret unexpected provisions as the sum of management's expectations of future loan losses plus a discretionary component. Unexpected changes in non-performing loans should be correlated with the components of unexpected provisions that reflect management's expectations of additional future loan losses. Unexpected chargeoffs should be correlated with the components of unexpected provisions relating to unanticipated loan losses of the current period. Taken together, this information should enable investors to estimate the component of unexpected provisions that represents a revision in management expectations about future loan losses. Thus, investors should also be able to estimate discretionary components in unexpected loan loss provisions. If so, then an interesting question emerges: what is revealed to investors by discretionary components of unexpected provisions?⁵

Prior empirical studies conjecture that discretionary components of provisions reveal private information of bank managers. For example, Beaver et al. (1989, 169) suggest that investors interpret an increase in loan loss provisions as a sign of strength, "... because it indicates that management perceives the earnings power of the bank to be sufficiently strong that it can withstand a 'hit to earnings' in the form of additional loan loss provisions."⁶

Theoretical research has only begun to explore the role of discretionary accruals as a mechanism to convey private information. In this setting, the use of discretion to increase reported provisions may be similar to the types of actions discussed in the signalling literature to address

⁴Contrary to the evidence in Moyer (1990), Collins et al. (1993) and Beatty et al. (1993) present evidence consistent with managers exercising discretion to reduce reported chargeoffs to avoid regulatory capital constraints.

⁵Antle et al. (1993) model interactions between accounting and non-accounting information, and the role of these interactions in the price-earnings relation.

⁶Barth et al. (1991) obtain a similar result in a study of thrifts. Referring to this result, Brennan (1991, 71) notes: "... Managers may choose certain balance sheet configurations precisely to communicate to the market their private information... It is at least arguable that those thrifts that are in better financial condition might be more willing to make a generous allowance for loan losses...." In addition, three studies detect positive market reactions to announcements of large provisions for foreign loans during 1987. Each suggests that the large provisions were credible signals of bank managers' intentions and abilities to resolve the foreign debt situation (Elliott et al. 1991, 847; Griffin and Wallach 1991, 831; Johnson 1989, 19). None of these studies test this conjecture.

adverse selection problems (Akerlof 1970; Spence 1973; Grossman 1981; Milgrom 1981). This literature states that the credibility of a signal, and thus the resulting separating equilibrium, hinges on the nature of the cost of the signal. To be credible, the cost of the signal must be increasing in the signal itself and must be greater for “bad” types. It is not clear, however, whether a discretionary increase in reported provisions is viewed by investors as a credible signal of private information because the nature of the cost of the signal to a bank manager is ambiguous.⁷ Theory and institutional details do not clearly support or reject signalling as an explanation for a positive relation between returns and provisions.

The effects of reputation on information asymmetry (Kreps and Wilson 1982; Milgrom and Roberts 1982) may also explain a positive relation between returns and unexpected provisions. Recent studies in accounting (e.g., Teoh and Hwang 1991; Healy and Palepu 1993) develop models in which “better” firms reveal their type through their willingness to disclose adverse news (i.e., greater loan loss provisions and lower earnings). Empirical tests of reputation are difficult for at least two reasons. First, empirical measures of financial reporting reputations, based on cross-sectional differences in reporting choices, are yet to be established. Second, to test the valuation effects of reputation *per se*, one must control for the relation between market value and underlying firm type, which is only observable *ex post*.

The empirical analyses in this paper do not directly test or distinguish between signalling or reputation effects as potential information-based explanations for a positive relation between returns and unexpected provisions. This study, however, does provide three sets of tests of *whether* such information-based explanations are plausible.

First, I examine the relations between unexpected loan loss provisions and both stock returns and changes in future cash flows. If the data are consistent with information-based explanations, then the components of unexpected provisions which are orthogonal to unexpected changes in non-performing loans and unexpected chargeoffs should be positively related to returns and changes in future cash flows. Second, if unexpected changes in non-performing loans and unexpected chargeoffs enable investors to observe discretionary components in unexpected provisions, then excluding them from a regression of returns (or changes in future cash flows) on unexpected provisions should substantially reduce the magnitude and significance of the coefficient on unexpected provisions. Third, if information-based explanations hold, then unexpected provisions should be positively related to stock price reactions when they are released.

Bank capital regulation provides another potential explanation for a positive relation between returns and unexpected provisions. As noted earlier, unexpected provisions increase regulatory capital by the related amount of accrued tax savings. Each additional dollar of capital enables a bank to acquire \$16 or more of additional deposits, and thus invest in new projects. Therefore, investors may interpret unexpected provisions as a proxy for profitable growth. To examine this capital-based explanation, I test the extent to which growth explains bank stock returns and future cash flows. If unexpected provisions are a proxy for growth, then the positive relation between unexpected provisions and future cash flows (and returns) should diminish substantially in magnitude and significance once growth is explicitly included in the analysis.

⁷ Increased provisions appear costly to managers of banks in terms of earnings-based compensation; however, provisions also increase regulatory capital ratios, and are beneficial to bank managers (particularly managers of under-capitalized banks). The cost to a bank manager of an increased provision must also be considered in light of the relative costs of using other signalling mechanisms (e.g., increased dividends), and the incentives to reveal private information.

III. Sample and Data

Tests of associations between loan loss information, future cash flows, and stock returns are conducted with annual returns and annual accounting data. Market reactions to the release of loan loss information are examined using event date returns and quarterly accounting data.

The annual data sample consists of the 106 commercial banks with at least eight years of data available over the period 1977 through 1988 from the: (1) 1988 Bank Compustat Tape, (2) 1989 CRSP Daily Returns Tape, and (3) Keefe, Bruyette and Woods *Bank Books* (non-performing loans data). Of the 149 banks covered by the 1988 Bank Compustat Tape, 16 were lost because less than eight years of data were available on CRSP, 20 were lost because less than eight years of data were available on Compustat, and 7 were lost because they were not followed by Keefe, Bruyette and Woods.

The quarterly data sample consists of the 86 banks with at least 16 quarters of data available during the 20 quarter period from 1984:4 through 1989:3. Quarterly accounting data were collected from the 1989 Bank Compustat tape. Quarterly returns and event date returns were obtained from the 1989 CRSP Daily Returns Tape. Quarterly non-performing loans data and financial statement release dates were hand-collected directly from 10Qs and 10Ks on file at the SEC offices in Chicago. Of the 150 banks covered by the 1989 Bank Compustat Tape, 47 were lost because less than 16 quarters of data were available on CRSP or Compustat and 17 were lost due to incomplete microfiche records at the Chicago office of the SEC.

Descriptive statistics for the annual and quarterly data are presented in table 1. These data suggest that non-performing loans disclosures are the broadest measures of potential future loan losses and are large relative to the market value of bank equity. The annual data indicate that mean (median) non-performing loans equal 60 percent (17 percent) of the market value of bank equity, are 66 percent (35 percent) larger than loan loss allowances, amount to 3.7 (2.8) years of provisions and almost 4.0 (3.8) years of loan chargeoffs.⁸ Provisions and chargeoffs are also large relative to the market value of equity. Mean (median) annual provisions equal 27 percent (6 percent) of the market value of common equity, 148 percent (38 percent) of annual earnings, and are 44 percent (34 percent) larger than chargeoffs. Mean (median) annual chargeoffs average 19 percent (5 percent) of the market value of common equity.

IV. Loan Loss Expectations Models

The focus of this paper is to analyze the information each loan loss disclosure conveys to investors. Therefore, it is necessary to estimate the unexpected component in each disclosure using models of investors' expectations as of the beginning of each year. The expectations models are based on the composition of each bank's loan portfolio and loan loss accounting practice, using the relations between outstanding loans, changes in non-performing loans, loan loss provisions, and loan chargeoffs. The residuals from each model serve as proxies for the unexpected components in each loan loss disclosure.

Expectations models are estimated over the pooled time-series cross-sectional sample using the following regressions:

$$\Delta NPL_{it} = a_0 + \sum_{j=1}^6 a_{1j} \text{LoansOut}_{jit-1} + a_2 \Delta NPL_{it-1} + U \Delta NPL_{it} \quad (E1)$$

$$LLP_{it} = b_0 + \sum_{j=1}^6 b_{1j} \text{LoansOut}_{jit-1} + b_2 E \Delta NPL_{it} + b_3 NPL_{it-1} + b_4 LLA_{it-1} + U LLP_{it} \quad (E2)$$

⁸ Unfortunately the non-performing loans data provided by Keefe, Bruyette and Woods are not broken down into types (e.g., non-accruals, restructurings, etc.). These data do not include past due loans, but do include real estate acquired in foreclosure, which typically comprises a small percentage of non-performing loans.

Table 1
Descriptive Statistics — Annual and Quarterly Data Samples

	ANNUAL (106 banks over 1977-1988)				QUARTERLY (86 banks over 1984:4 - 1989:3)			
	N	MEAN	MEDIAN	STD. DEV.	N	MEAN	MEDIAN	STD. DEV.
TOTALS (\$MM)								
Changes in Non-Performing Loans	1246	26.9	1.5	188.7	1629	13.4	0.4	154.1
Non-Performing Loans (NPL)	1252	222.8	44.8	587.4	1682	431.6	91.4	974.3
Loan Loss Provisions (LLP)	1256	75.9	15.3	237.4	1720	45.0	10.5	156.8
Loan Chargeoffs (LCO)	1256	52.3	11.2	148.0	1718	28.2	8.6	62.0
Loan Loss Allowances (LLA)	1257	129.9	32.8	346.9	1720	289.6	76.1	600.7
Pre-Loan Loss Earnings (PreLLE)	1256	164.2	55.8	334.5	1720	79.2	32.2	132.4
Earnings (E)	1257	62.2	32.0	164.2	1720	22.5	16.7	133.6
Book Value of Equity (BV)	1250	579.1	260.6	866.4	1717	932.2	492.4	1138.0
Market Value of Equity (MV)	1208	624.0	288.7	937.0	1718	1105.0	650.8	1295.7
RATIOS								
NPL/MV	1201	0.60	0.17	4.70	1680	0.47	0.14	1.79
LLP/MV	1208	0.27	0.06	2.70	1718	0.04	0.02	0.22
LCO/MV	1208	0.19	0.05	1.80	1716	0.04	0.01	0.18
NPL/LLA	1242	1.66	1.35	1.30	1682	1.31	1.09	0.79
NPL/LLP	1241	3.65	2.84	4.10	1679	14.20	9.05	31.70
NPL/LCO	1242	3.98	3.81	50.00	1675	17.30	12.00	48.50
LLP/LCO	1256	1.44	1.34	5.90	1713	2.07	1.26	12.70
LLP/Earnings	1256	1.48	0.38	21.40	1720	0.89	0.45	5.50
Returns	1272	0.18	0.14	0.33	1641	0.04	0.04	0.15

$$LCO_{it} = c_0 + \sum_{j=1}^6 c_{1j} \text{LoansOut}_{jit-1} + c_2 E\Delta NPL_{it} + c_3 NPL_{it-1} + c_4 LLA_{it-1} + ULCO_{it} \quad (E3)$$

where: ΔNPL_{it} is the change in non-performing loans of bank i during year t ($NPL_{it} - NPL_{it-1}$); LLP_{it} and LCO_{it} are loan loss provisions and loan chargeoffs (net of recoveries), respectively; LoansOut_{jit-1} are the beginning balances in six loan categories: Commercial, Consumer, Real Estate, Foreign, Loans to Other Financial Institutions, and Other Loans; $E\Delta NPL_{it}$ is the predicted value from equation (E1); LLA_{it-1} is the beginning balance in the loan loss allowance account; $U\Delta NPL_{it}$, $ULLP_{it}$, $ULCO_{it}$ are residuals (mean zero random variables); and all variables are scaled by the beginning market value of equity of bank i , year t (MV_{it-1}) to mitigate potential estimation problems from heteroskedasticity.

Different types of loans involve different default risks. Investors are likely to form expectations of loan losses on the basis of each bank's loan portfolio composition. Thus, beginning balances in the six loan categories available on Bank Compustat are included in each model to capture variation in expected loan losses across loans with different default risks.

Changes in non-performing loans, which are bank-specific leading indicators of potential future loan losses, are likely to be serially correlated. If so, investors are likely to use past changes in non-performing loans to predict future changes in non-performing loans. Equation (E1) includes ΔNPL_{it-1} to control for this possibility.

Accounting practice suggests that ΔNPL s precede or coincide with provisions and chargeoffs. Thus, beginning total non-performing loans are included in equations (E2) and (E3) as a measure of prior ΔNPL s. The expected ΔNPL as of the beginning of year t is also included in equations (E2) and (E3) as a proxy for investor expectations of current year ΔNPL s. Investors are also likely to use past provisions in forming expectations of future provisions and future chargeoffs. Accounting practice suggests prior provisions should be negatively related to future provisions but positively related to future chargeoffs. Thus, the beginning balance in the loan loss allowance is included in equations (E2) and (E3) as a measure of prior provisions.

Coefficient estimates of expectations models (E1)–(E3) are presented in table 2 for the pooled annual sample. The coefficient estimates confirm the above description of loan loss accounting practice. Changes in non-performing loans are positively serially correlated. The estimated coefficients in equations (E2) and (E3) on prior and expected changes in non-performing loans indicate that increases in non-performing loans are leading indicators of greater provisions and chargeoffs. The coefficients on the loan loss allowance variable indicate that larger provisions in prior periods lead to smaller provisions and larger chargeoffs in the current period. These disclosures also vary significantly across banks investing in different types of loans. In addition, the estimated models have relatively high R^2 s, indicating these (ad hoc) models are reasonable.⁹

Expectations models for quarterly loan loss disclosures are also estimated (not reported separately here). The quarterly models are analogous to the annual models except that beginning balances in categories of loans outstanding are not included because these data are not reported

⁹ The pooled expectations models implicitly assume the parameters are stationary over the study period and equal across firms. To examine the importance of firm and year effects, the expectations models were estimated using a fixed effects model, including separate intercepts for each firm and year (or quarter), and then the test equations were re-estimated. The test results reported in this paper are not sensitive to this alternative specification of the expectations models. In addition, the expectations models were also examined using separate annual cross-sectional regressions to allow the coefficient estimates to vary over time with changing economic and regulatory conditions. The coefficients that are particularly significant in the pooled regressions are consistently significant in the annual cross-sectional regressions.

Table 2
Expectations Models for Annual Loan Loss Disclosures

Estimates of the relations between types of loans outstanding, changes in non-performing loans, loan loss provisions and loan chargeoffs for a pooled cross-sectional sample of 106 banks with annual data over 1977-1988.

$$\Delta NPL_{it} = a_0 + \sum_{j=1}^6 a_{1j} \text{LoansOut}_{jit-1} + a_2 \Delta NPL_{it-1} + U \Delta NPL_{it} \quad (E1)$$

$$LLP_{it} = b_0 + \sum_{j=1}^6 b_{1j} \text{LoansOut}_{jit-1} + b_2 E \Delta NPL_{it} + b_3 NPL_{it-1} + b_4 LLA_{it-1} + ULLP_{it} \quad (E2)$$

$$LCO_{it} = c_0 + \sum_{j=1}^6 c_{1j} \text{LoansOut}_{jit-1} + c_2 E \Delta NPL_{it} + c_3 NPL_{it-1} + c_4 LLA_{it-1} + ULCO_{it} \quad (E3)$$

VARIABLES:	Intercept	ΔNPL_{it-1}	$E \Delta NPL_{it}$	NPL_{it-1}	LLA_{it-1}	Commercial	Consumer	Real Estate	Foreign	Fin. Insts.	Other
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Changes in Non-Performing Loans:

Coefficient Estimates: .069
(t-statistics): (2.7)
N=991 $R^2=0.173$

Loan Loss Provisions:

Coefficient Estimates: -.048
(t-statistics): (-1.8)
N=994 $R^2=0.724$

Loan Chargeoffs:

Coefficient Estimates: -.046
(t-statistics): (-4.1)
N=994 $R^2=0.909$

Continued

Table 2 (Continued)

The variables in table 2 are defined as:

ΔNPL_{it} = the change in non-performing loans of bank i during year t ($NPL_{it} - NPL_{it-1}$);

LLP_{it} = loan loss provisions;

LCO_{it} = loan chargeoffs (net of recoveries);

$LoansOut_{jit-1}$ = beginning balances in six loan categories: Commercial, Consumer, Real Estate, Foreign, Loans to Other Financial Institutions, and Other Loans;

$E\Delta NPL_{it}$ = the predicted value from equation (E1);

LLA_{it-1} = the beginning balance in the loan loss allowance account;

$U\Delta NPL_{it}$, $ULLP_{it}$, $ULCO_{it}$ denote residuals (mean zero random variables).

All variables are scaled by the beginning market value of equity of bank i , year t (MV_{it-1}) to mitigate potential estimation problems from heteroskedasticity.

quarterly. The signs and significance of the coefficient estimates from the quarterly models are consistent with those of the annual models. The residuals from the quarterly models are used as proxies for unexpected loan loss information in tests of quarterly returns and event date returns.

In general, correlations among the three loan loss disclosures and among their unexpected components are positive and significant. In particular, unexpected provisions are highly positively correlated with unexpected chargeoffs. Overall it appears that these three loan loss disclosures, and their unexpected components, are closely related but distinct measures of changes in the level of default risk inherent in a bank's portfolio. The next section analyzes the unexpected loan loss disclosures for information about future cash flows.

V. Cash Flow Predictions

The information-based explanations suggest managers increase reported provisions when future cash flow prospects improve. Thus, unexpected provisions are predicted to be positively related to changes in future cash flows, controlling for unexpected changes in non-performing loans and unexpected chargeoffs. The information in each loan loss disclosure for future cash flows is examined by analyzing the relation between each disclosure and a pooled time-series of future changes in pre-loan loss earnings. Data available on Bank Compustat do not include a reported measure of cash flow from operations and do not enable a direct calculation of such a measure. Pre-loan loss earnings approximate bank cash flows, however, because the loan loss provision is the most significant accrual affecting bank earnings. Data on less substantial accruals, such as depreciation expense, deferred tax expense, and accrued components of interest revenue and expense, are not available on Bank Compustat. In addition, an analysis of the relation between loan loss provisions and future earnings would be confounded because current provisions are correlated with future provisions, which affect future earnings.

The relations between future changes in pre-loan loss earnings and unexpected changes in non-performing loans, unexpected provisions and unexpected chargeoffs are estimated with:

$$\Delta PreLLE_{it+j} = \delta_0 + \delta_1 \Delta PreLLE_{it} + \delta_2 U' \Delta NPL_{it} + \delta_3 U' LLP_{it} + \delta_4 U' LCO_{it} + e_{it}, \quad (1)$$

where: $\Delta PreLLE_{it+j}$ denotes the change in pre-loan loss earnings, for bank i year $t+j$ ($PreLLE_{it+j} - PreLLE_{it+j-1}$); $U' \Delta NPL_{it}$, $U' LLP_{it}$ and $U' LCO_{it}$ denote the unexpected loan loss disclosures

estimated in equations (E1)–(E3), rescaled to dollars by multiplying by MV_{it-1} , respectively; and e_{it} denotes a mean zero random variable.

Equation (1) is estimated using the annual sample with a two-stage weighted least squares procedure. Equation (1) is estimated separately for each firm, providing firm-specific estimates of residual standard errors.¹⁰ The regressors and dependent variable are then scaled by these estimated standard errors, and the equation is re-estimated using the pooled sample. This procedure controls for differences in the intertemporal variance of $\Delta PreLLE_{it}$ across firms, and mitigates potential estimation problems from heteroskedasticity. The model includes $\Delta PreLLE_{it}$ to control for potential autocorrelation in changes in pre-loan loss earnings.

The results are presented in table 3, panel A. Unexpected provisions are positively related to the change in pre-loan loss earnings one year ahead. This result is consistent with bank managers increasing provisions when future cash flow prospects improve. Unexpected changes in non-performing loans and unexpected chargeoffs are negatively related to the one year ahead change in pre-loan loss earnings. The coefficient on $\Delta PreLLE_{it}$ indicates standardized changes in pre-loan loss earnings are positively autocorrelated and do not follow a random walk.¹¹

To test whether unexpected provisions are related to permanent or transitory changes in cash flows, equation (1) is re-estimated using changes in pre-loan loss earnings two and three years ahead ($j=2,3$). If unexpected provisions are related to transitory changes in cash flows, then the direction of these changes should reverse and the estimated coefficient on $U'LLP_{it}$ should become negative. The results are presented in table 3, panels B and C. Unexpected provisions in year t are positively related to changes in pre-loan loss earnings two and three years ahead. It appears that unexpected provisions are related to extremely persistent changes in future cash flows that continue to increase, at a diminishing rate, over three years. The sum of the estimated coefficients suggests that a one percent increase in unexpected provisions is related to a .88% increase in cash flows over the following three years, *ceteris paribus*. Bank managers appear to increase provisions when future cash flows increase, consistent with information-based explanations.¹²

Unexpected changes in non-performing loans and unexpected chargeoffs remain negatively related to changes in pre-loan loss earnings two and three years ahead. All of the estimated coefficients diminish with time.¹³ This is likely due to changes in the loan portfolio composition and changes in economic conditions obscuring the relation between loan loss information at time t and cash flows in the more distant future.

The information-based explanations require that investors observe discretionary increases in reported provisions. Contemporaneous unexpected changes in non-performing loans and unexpected chargeoffs should enable investors to detect discretionary components in unexpected provisions. If the information in $U'LLP_{it}$ for future cash flows is conditional on $U'\Delta NPL_{it}$ and $U'LCO_{it}$, then the estimated coefficient on $U'LLP_{it}$ (δ_3) should become negative when estimated

¹⁰ These estimates require a minimum of six degrees of freedom per firm. As a result, they can only be obtained for the 91 firms in the sample with at least nine observations because two degrees of freedom per firm are used in estimating expectations models, and one degree of freedom per firm is used to difference pre-loan loss earnings.

¹¹ Autocorrelations of residuals from equation (1) estimated with changes in pre-loan loss earnings one, two and three years ahead are -.04, .07, and .30, respectively. Equation (1) is re-estimated for changes in pre-loan loss earnings one year ahead using a fixed effects model including separate intercepts for each firm and each year to mitigate potential for both serial and cross-sectional correlation in residuals. The signs and magnitudes of the test statistics on the loan loss variables remain largely unchanged.

¹² The results are qualitatively similar, although less significant, when equation (1) is estimated with all of the variables scaled by market value as of the beginning of year t , or when equation (1) is estimated using quarterly data. See Wahlen (1991) for more detail.

¹³ The relations between the unexpected loan loss variables and changes in pre-loan loss earnings four years ahead converge to zero, although the negative coefficient on non-performing loans remains statistically significant.

Table 3
Annual Loan Loss Disclosures and Future Changes in Pre-Loan Loss Earnings

This table presents regression analyses of the relations between annual unexpected changes in non-performing loans, unexpected loan loss provisions and unexpected loan chargeoffs and future changes in pre-loan loss earnings (as proxies for future changes in cash flows) up to three years ahead ($j=1-3$). The models are estimated with annual data for a pooled sample of 106 banks over 1977-1988 using weighted least squares.

$$\Delta \text{PreLLE}_{it+j} = \delta_0 + \delta_1 \Delta \text{PreLLE}_{it} + \delta_2 U' \Delta \text{NPL}_{it} + \delta_3 U' \text{LLP}_{it} + \delta_4 U' \text{LCO}_{it} + e_{it} \quad (1)$$

<i>COEFFICIENTS:</i>	δ_0	δ_1	δ_2	δ_3	δ_4
Predicted Signs:	—	—	(-)	(+)	(-)

PANEL A: One Year Ahead

Coefficient Estimates:	.891	.282	-.171	.452	-.867
(t-statistics):	(8.3 ^b)	(6.6 ^b)	(-9.6 ^b)	(13.0 ^b)	(-12.5 ^b)
N = 813 Adj. R ² = .254					

PANEL B: Two Years Ahead

Coefficient Estimates:	1.132	.311	-.128	.304	-.585
(t-statistics):	(9.7 ^b)	(5.9 ^b)	(-6.2 ^b)	(5.0 ^b)	(-5.3 ^b)
N = 718 Adj. R ² = .159					

PANEL C: Three Years Ahead

Coefficient Estimates:	1.679	.576	-.113	.125	-.336
(t-statistics):	(7.9 ^b)	(10.3 ^b)	(-4.4 ^b)	(2.1 ^a)	(-3.5 ^b)
N = 628 Adj. R ² = .273					

The variables in table 3 are defined as:

$\Delta \text{PreLLE}_{it}$ = the change in pre-loan loss earnings for bank i , year t ;

$U' \Delta \text{NPL}_{it}$ = the unexpected change in non-performing loans;

$U' \text{LLP}_{it}$ = unexpected loan loss provisions;

$U' \text{LCO}_{it}$ = unexpected loan chargeoffs.

$U' \Delta \text{NPL}_{it}$, $U' \text{LLP}_{it}$ and $U' \text{LCO}_{it}$ denote the unexpected loan loss disclosures estimated in equations (E1)-(E3), rescaled to dollars by multiplying by MV_{it-1} , respectively. A weighted least squares procedure is used in which each model is first estimated separately for each firm, providing firm-specific estimates of the residual standard errors. Each variable is then scaled by the estimated residual standard error and each model is re-estimated using the pooled sample.

^a = significant at $< .05$; ^b = significant at $< .01$; two-tailed tests.

(Continued)

Table 3 (Continued)
Annual Loan Loss Disclosures and Future Changes in Pre-Loan Loss Earnings

PANEL D: Tests of the relations between each individual loan loss disclosure and future changes in pre-loan loss earnings. T-statistics are presented in parentheses below each coefficient estimate.

$$\Delta \text{PreLLE}_{it+j} = \delta_0 + \delta_1 \Delta \text{PreLLE}_{it} + \delta_2 U' \Delta \text{NPL}_{it} + \delta_3 U' \text{LLP}_{it} + \delta_4 U' \text{LCO}_{it} + e_{it} \quad (1)$$

COEFFICIENTS:	δ_0	δ_1	δ_2	δ_3	δ_4
Predicted Signs:	—	—	(-)	(+)	(-)
<u>One Year Ahead:</u>					
$U' \Delta \text{NPL}_{it}$: N = 813 R ² = .090	.914 (7.8 ^b)	.307 (6.5 ^b)	-.075 (-4.4 ^b)	—	—
$U' \text{LLP}_{it}$: N = 814 R ² = .025	1.168 (9.3 ^b)	.134 (3.0 ^b)	—	.088 (3.7 ^b)	—
$U' \text{LCO}_{it}$: N = 814 R ² = .025	1.276 (10.2 ^b)	.115 (2.5 ^a)	—	—	-.192 (-3.8 ^b)
<u>Two Years Ahead:</u>					
$U' \Delta \text{NPL}_{it}$: N = 718 R ² = .130	1.033 (8.8 ^b)	.366 (7.0 ^b)	-.107 (-5.4 ^b)	—	—
$U' \text{LLP}_{it}$: N = 718 R ² = .095	1.021 (8.5 ^b)	.446 (8.6 ^b)	—	-.126 (-0.4)	—
$U' \text{LCO}_{it}$: N = 718 R ² = .104	1.028 (8.6 ^b)	.449 (8.8 ^b)	—	—	-.168 (-2.7 ^b)
<u>Three Years Ahead:</u>					
$U' \Delta \text{NPL}_{it}$: N = 628 R ² = .263	1.653 (7.8 ^b)	.577 (10.5 ^b)	-.121 (-5.6 ^b)	—	—
$U' \text{LLP}_{it}$: N = 628 R ² = .240	1.496 (6.9 ^b)	.691 (13.5 ^b)	—	-.122 (-3.4 ^b)	—
$U' \text{LCO}_{it}$: N = 628 R ² = .255	1.530 (7.2 ^b)	.684 (13.4 ^b)	—	—	-.308 (-4.9 ^b)

alone. Alternatively, if the information in $U'LLP_{it}$ is independent of the information in the other two disclosures, then the estimate of δ_3 should remain positive.

Estimates of equation (1) with each unexpected loan loss disclosure examined individually are presented in table 3, panel D. Taken individually, the relation between $U'LLP_{it}$ and future changes in cash flows remains positive for year $t+1$, but is zero in year $t+2$, and negative in year $t+3$. In contrast, $U'\Delta NPL_{it}$ and $U'LCO_{it}$ are each negatively related to future changes in cash flows through three years into the future. The magnitudes and significance of the coefficients on $U'\Delta NPL_{it}$ and $U'LCO_{it}$ through year $t+2$ are less than those obtained when all three disclosures are examined jointly.

The R^2 s of the models, and the magnitudes and significance of the coefficients are all greatest when all three disclosures are examined jointly. These results indicate that more information about future cash flows is obtained when the three loan loss disclosures are interpreted together. In particular, these results suggest that $U'LLP_{it}$ is "good news" about future cash flows in years $t+2$ and $t+3$ only when examined in conjunction with $U'\Delta NPL_{it}$ and $U'LCO_{it}$.

The capital-based explanation states that a discretionary increase in reported provisions increases regulatory capital, enabling a bank to increase future cash flows through growth.¹⁴ To test whether unexpected provisions precede growth, the current period change in total assets (and alternatively, the change in total loans outstanding) is included in equation (1). The results (not reported here) suggest growth is an important variable explaining future bank cash flows; however, the relation between unexpected provisions and future cash flows remains largely unchanged.

Equation (1) is also re-estimated over partitions of the sample facing non-binding (binding) capital constraints. If the capital-based explanation holds, then the positive relation between unexpected provisions and future cash flows is likely to be driven by provisions reported by under-capitalized banks. The results indicate that unexpected provisions of banks not facing binding capital constraints remain significantly and positively related to changes in future cash flows. Thus, the positive relation between unexpected provisions and future cash flows is not solely being driven by growth due to provisions recorded to increase regulatory capital.

The evidence is consistent with information-based explanations. Bank managers appear to increase reported provisions when future cash flow prospects improve. Also, unexpected changes in non-performing loans and unexpected chargeoffs are important pieces of information, and are negatively related to future bank performance.¹⁵ Following sections examine how these disclosures affect bank stock returns.

VI. Valuation Implications of Loan Loss Disclosures

This section examines the valuation implications of the loan loss disclosures. First, a valuation model is extended to address the relations between bank stock returns and changes in non-performing loans, loan loss provisions, and loan chargeoffs. Second, empirical tests are conducted using this framework to examine the valuation implications of each of the loan loss disclosures.

¹⁴The data in this study appear to reflect the phenomenon observed in Moyer (1990). Unexpected provisions of banks facing binding capital constraints average 11.4% of the market value of equity, whereas unexpected provisions of banks facing non-binding constraints average -2.9%.

¹⁵The three loan loss disclosures are also related to the current performance of a bank. Results of separate tests suggest unexpected changes in non-performing loans and unexpected chargeoffs are negatively related to current changes in pre-loan loss earnings, consistent with the idea that these loans are not paying interest. Unexpected provisions are positively related to current changes in pre-loan loss earnings. Discretionary components of unexpected provisions appear to be used to "smooth" earnings.

A Model of the Valuation Implications of Loan Loss Disclosures

Consider the following:

$$MV_{it} = BV_{it} + MVL_{it} - BVL_{it} + MVONA_{it} - BVONA_{it}, \quad (2)$$

where MV_{it} denotes the market value of common equity of bank i at time t ; BV_{it} denotes the book value of common equity; $MVL_{it} - BVL_{it}$ denotes the difference between the market value and book value of outstanding loans; and $MVONA_{it} - BVONA_{it}$ denotes the difference between the market and book values of all other assets, net of all liabilities and preferred stock. As in Beaver et al. (1989), assume that the difference between the market and book values of loans outstanding is linearly related to the total non-performing loans (NPL_{it}) and the loan loss allowance account (LLA_{it}): $MVL_{it} - BVL_{it} = a_1 NPL_{it} + a_2 LLA_{it} + u_{1it}$, where u_{1it} has mean zero. Beaver et al. also assume that the difference between the market and book values of all other net assets can be expressed (with error) as a linear function of the book value of common equity: $MVONA_{it} - BVONA_{it} = \mu BV_{it} + u_{2it}$, where u_{2it} has mean zero. Substituting into equation (2) yields:

$$MV_{it} = (1+\mu)BV_{it} + a_1 NPL_{it} + a_2 LLA_{it} + u_{1it} + u_{2it}. \quad (3)$$

The valuation implications of changes in non-performing loans, loan loss provisions and loan chargeoffs can be addressed by extending equation (3) to a model of changes in bank market values. If the coefficients in equation (3) are constant over time, then differencing equation (3) yields:

$$\Delta MV_{it} = (1+\mu)\Delta BV_{it} + a_1 \Delta NPL_{it} + a_2 \Delta LLA_{it} + \Delta u_{1it} + \Delta u_{2it}. \quad (4)$$

The change in the book value of equity can be written as the net change in common stock outstanding less dividends plus earnings; that is, $\Delta BV_{it} = \Delta CE_{it} - \text{Divs}_{it} + E_{it}$. The change in the loan loss allowance is equal to the provision less the chargeoff: $\Delta LLA_{it} = LLP_{it} - LCO_{it}$. The dependent variable can be converted to returns by adding Divs_{it} to both sides and then scaling all terms by MV_{it-1} . Incorporating these changes into equation (4) and relaxing the constraints on the coefficients yields:

$$R_{it} = (1 - c_0) \frac{\text{Divs}_{it}}{MV_{it-1}} + c_1 \frac{\Delta CE_{it}}{MV_{it-1}} + c_2 \frac{E_{it}}{MV_{it-1}} + c_3 \frac{\Delta NPL_{it}}{MV_{it-1}} + c_4 \frac{LLP_{it}}{MV_{it-1}} + c_5 \frac{LCO_{it}}{MV_{it-1}} + \frac{u_{3it}}{MV_{it-1}}. \quad (5)$$

Returns clustered in time and industry are likely to be correlated. Common components of residual returns in equation (5) may be related to the contemporaneous index of annual returns to the S&P Financial 40 (R_{FMT}). To control for industry-wide movements in returns, and to mitigate potential cross-correlation,¹⁶ the residual returns for firm i from equation (5) are rewritten as: $u_{3it}/MV_{it-1} = a_i + b_i R_{FMT} + u_{4it}$. Firm-specific parameters a_i and b_i are included because an F-test rejects the restriction that these coefficients are equal for all banks in this sample. In addition, to estimate the association between returns and provisions, it is necessary to separate provisions from other

¹⁶Bernard (1987) shows that test statistics from cross-sectional OLS regressions of long-window returns clustered in time against firm-specific regressors have the potential to be seriously overstated. The degree of bias depends on the covariation between residual cross-correlations and regressor cross-correlations. However, the degree of bias may be reduced in a single industry study because there may be little variation in residual cross-correlations across firm-pairs. See Bernard (1987) for further discussion.

components of earnings. Earnings are equal to pre-loan loss provision earnings minus the loan loss provision: $E_{it} = \text{PreLLE}_{it} - \text{LLP}_{it}$. Rewriting equation (5) provides:

$$R_{it} = a_i + b_i R_{FMT} + d_0 \frac{\text{Divs}_{it}}{\text{MV}_{it-1}} + d_1 \frac{\Delta \text{CE}_{it}}{\text{MV}_{it-1}} + d_2 \frac{\text{PreLLE}_{it}}{\text{MV}_{it-1}} + d_3 \frac{\Delta \text{NPL}_{it}}{\text{MV}_{it-1}} + (d_4 - d_2) \frac{\text{LLP}_{it}}{\text{MV}_{it-1}} + d_5 \frac{\text{LCO}_{it}}{\text{MV}_{it-1}} + u_{4it} \quad (6)$$

This model implicitly assumes that each RHS variable scaled by MV_{it-1} reflects new information. This assumption appears reasonable for pre-loan loss earnings scaled by MV_{it-1} .¹⁷ In contrast, estimates of the loan loss expectations models demonstrate that ratios of loan loss variables over market values are predictable. Therefore, ΔNPL_{it} , ULLP_{it} , and ULCO_{it} (already scaled by MV_{it-1}) are used as proxies for the new information in the loan loss disclosures. Substituting these terms into equation (6) yields:

$$R_{it} = \alpha_i + \beta_i R_{FMT} + \lambda_0 \frac{\text{Divs}_{it}}{\text{MV}_{it-1}} + \lambda_1 \frac{\Delta \text{CE}_{it}}{\text{MV}_{it-1}} + \lambda_2 \frac{\text{PreLLE}_{it}}{\text{MV}_{it-1}} + \lambda_3 \Delta \text{NPL}_{it} + (\lambda_4 - \lambda_2) \text{ULLP}_{it} + \lambda_5 \text{ULCO}_{it} + u_{5it} \quad (7)$$

The coefficient on ULLP_{it} is an estimate of $(\lambda_4 - \lambda_2)$. The parameter $-\lambda_2$ captures the return associated with the effect of unexpected provisions (as an expense) on current earnings, holding constant the return associated with any additional information in unexpected provisions for future cash flows. The parameter λ_4 captures the return associated with unexpected provisions as additional information about future cash flows, holding constant the return associated with the impact of unexpected provisions on current earnings. If the market prices \$1 of unexpected provisions and \$1 of any other unexpected current expense equally (e.g., unexpected provisions contain no additional information about future cash flows), then $(\lambda_4 - \lambda_2)$ should equal $-\lambda_2$. If unexpected provisions are interpreted as a current period expense as well as additional information positively related to future cash flows, then $(\lambda_4 - \lambda_2)$ should be greater than $-\lambda_2$.

In addition, if ΔNPL_{it} and ULCO_{it} reflect the "bad news" inherent in unexpected provisions, then λ_3 and λ_5 should be negative. Also, if these two disclosures are important conditioning variables for unexpected provisions, then including them in this regression should have a significant impact on the coefficient on ULLP_{it} .

Tests of the Valuation Implications of Loan Loss Disclosures

Estimates of bank stock returns associated with each of the unexpected loan loss variables are obtained using equation (7) for the pooled annual sample (table 4, panel A). Both ΔNPL_{it} and ULCO_{it} are negatively related to bank stock returns. Given unexpected provisions, it appears that unexpected changes in non-performing loans and unexpected loan chargeoffs provide significant additional loan loss information to investors. In contrast, ULLP_{it} is positively related to returns, given ΔNPL_{it} and ULCO_{it} . The estimate of $(\lambda_4 - \lambda_2)$ is 0.204 ($t = 2.5$). Consistent with

¹⁷To examine the time-series structure in $\text{PreLLE}_{it}/\text{MV}_{it-1}$, a first-order autoregression was estimated over the pooled annual sample. The results indicate $\text{PreLLE}_{it}/\text{MV}_{it-1}$ has characteristics of an information variable: it is primarily white noise around a non-zero mean. In a similar vein, Ohlson (1988a; 1988b; 1989) shows that, under certain assumptions, earnings levels scaled by MV_{it-1} may be reasonable proxies for scaled unexpected earnings because MV_{it-1} implicitly reflects an earnings expectation model (e.g., E/P ratios are white noise around non-zero means). Easton and Harris (1991) present evidence consistent with this idea.

Table 4
Relations between Bank Stock Returns and Unexpected Loan Loss Disclosures

Regression analyses of annual bank stock returns associated with annual unexpected changes in non-performing loans, unexpected loan loss provisions and unexpected chargeoffs. The models are estimated using OLS on a pooled sample of 106 banks over 1977-1988.

PANEL A: Regression analysis of annual returns associated with annual loan loss disclosures and pre-loan loss earnings.

$$\mathbf{R}_{it} = \alpha_i + \beta_1 \mathbf{R}_{FMT} + \lambda_0 \frac{\text{Divs}_{it}}{\text{MV}_{it-1}} + \lambda_1 \frac{\text{ACE}_{it}}{\text{MV}_{it-1}} + \lambda_2 \frac{\text{PreLLE}_{it}}{\text{MV}_{it-1}} + \lambda_3 \text{U}\Delta\text{NPL}_{it} + (\lambda_4 - \lambda_2) \text{ULLP}_{it} + \lambda_5 \text{ULCO}_{it} + u_{5it} \quad (7)$$

Coefficients:	α_i	β_i	λ_0	λ_1	λ_2	λ_3	$\lambda_4 - \lambda_2$	λ_5
Predicted Signs:	—	—	—	—	(+)	(-)	(+/-)	(-)
Coefficient Estimates: (t-statistics):	—	—	1.485 (3.3 ^c)	.013 (0.3 ^b)	.580 (7.9 ^c)	-.142 (-3.9 ^c)	.204 (2.5 ^b)	-.688 (-4.9 ^c)

N=985 Adj. R²= 0.678

PANEL B: Regression analysis of annual returns associated with annual loan loss disclosures and earnings.

$$R_{it} = \alpha_i + \beta_1 R_{F_{it}} + \lambda_0 \frac{\text{Div}_{it}}{MV_{i,t-1}} + \lambda_1 \frac{\Delta CE_{it}}{MV_{i,t-1}} + \lambda_2 \frac{E_{it}}{MV_{i,t-1}} + \lambda_3 \text{UANPL}_{it} + \lambda_4 \text{ULLP}_{it} + \lambda_5 \text{ULCO}_{it} + u_{6it} \quad (8)$$

Coefficients:	α_i	β_i	λ_0	λ_1	λ_2	λ_3	λ_4	λ_5
Predicted Signs:	—	—	—	—	(+)	(-)	(+)	(-)
Coefficient Estimates: (t-statistics):	—	—	2.484 (5.6°)	-.017 (-0.4)	.171 (3.4°)	-.112 (-3.0°)	.355 (4.4°)	-.842 (-5.8°)
N=985 Adj. R ² = 0.657								
<i>Continued</i>								

Table 4 (Continued)

PANEL C: Tests of returns implications of individual loan loss disclosures. Coefficient estimates are presented with t-statistics in parentheses below.

$$R_{it} = \alpha_i + \beta_1 R_{PMt} + \lambda_0 \frac{\text{Div}_{it}}{\text{MV}_{it-1}} + \lambda_1 \frac{\Delta CE_{it}}{\text{MV}_{it-1}} + \lambda_2 \frac{E_{it}}{\text{MV}_{it-1}} + \lambda_3 \Delta \text{NPL}_{it} + \lambda_4 \text{ULLP}_{it} + \lambda_5 \text{ULCO}_{it} + u_{6it} \quad (8)$$

Coefficients:	α_i	β_1	λ_0	λ_1	λ_2	λ_3	λ_4	λ_5
Predicted Signs:	—	—	—	—	(+)	(-)	(+)	(-)
UANPL _{it} : N=985 Adj. R ² = 0.643	—	—	2.432 (5.5 ^c)	.044 (1.1)	.258 (5.4 ^c)	-.055 (-1.6 ^a)	—	—
ULLP _{it} : N=987 Adj. R ² = 0.642	—	—	2.355 (5.3 ^c)	.076 (1.8 ^a)	.277 (5.7 ^c)	—	-.014 (-0.2)	—
ULCO _{it} : N=987 Adj. R ² = 0.649	—	—	2.152 (4.9 ^c)	-.016 (-0.4)	.196 (3.8 ^c)	—	—	-.456 (-4.1 ^b)

Notes to table 4: The variables above are defined as:

- R_{it} = annual stock returns for bank i on CRSP, cumulated from 4/1/ t through 3/31/ $t+1$;
- R_{PMt} = contemporaneous returns index constructed from the S&P Financial 40 Stock Price Index;
- Div_{it} = total dividends paid by bank i with ex-dates from 4/1/ t through 3/31/ $t+1$;
- ΔCE_{it} = the net change in common equity for bank i , year t (excluding earnings and dividends);
- PreLL_{it} = pre-loan loss earnings;
- E_{it} = earnings;
- ΔNPL_{it} = unexpected change in non-performing loans;
- ULLP_{it} = unexpected loan loss provisions;
- ULCO_{it} = unexpected loan chargeoffs;
- MV_{it-1} = the market value of equity of bank i as of 3/31/ t .

Annual sample: $i = 1$ to 106.

^a = significant at $< .10$; ^b = significant at $< .05$; ^c = significant at $< .01$; two-tailed tests.

the results of the cash flow predictions tests, the market interprets unexpected provisions as “good news” despite the fact that unexpected provisions reduce earnings.¹⁸

A more direct estimate of the returns associated with any additional information in unexpected provisions for future cash flows can be obtained by substituting (E_{it}/MV_{it-1}) for $(PreLLE_{it}/MV_{it-1})$. This substitution constrains the estimated coefficient on all components of current earnings (including $ULLP_{it}$ as an unexpected expense) to equal $-\lambda_2$. The parameter λ_4 , therefore, captures the return associated with any additional information in $ULLP_{it}$ about future cash flows. This substitution yields:

$$R_{it} = \alpha_i + \beta_1 R_{Ft} + \lambda_0 \frac{Divs_{it}}{MV_{it-1}} + \lambda_1 \frac{\Delta CE_{it}}{MV_{it-1}} + \lambda_2 \frac{E_{it}}{MV_{it-1}} + \lambda_3 \Delta NPL_{it} + \lambda_4 ULLP_{it} + \lambda_5 ULCO_{it} + u_{6it} \quad (8)$$

Estimates of the coefficients in equation (8) for the pooled annual sample are presented in table 4, panel B. The estimate of λ_4 is 0.355 ($t = 4.4$). The market interprets the portion of $ULLP_{it}$ that is orthogonal to ΔNPL_{it} and $ULCO_{it}$ as an important piece of “good news.” The conclusions from panels A and B of table 4 are robust to several alternative specifications.¹⁹

To examine whether the relations observed between returns and annual loan loss disclosures are evident in quarterly data, equations (7) and (8) are re-estimated using the quarterly sample. The results (not reported separately here) are consistent with those obtained from the annual data sample. In particular, the estimate of the coefficient on $ULLP_{it}$ is significantly positive and the estimated coefficients on ΔNPL_{it} and $ULCO_{it}$ are both significantly negative.

The information-based explanations hinge on investors being able to detect when managers exercise reporting discretion to increase reported provisions. Equation (8) is re-estimated with each loan loss disclosure examined individually to examine whether investors interpret unexpected provisions conditioned on unexpected changes in non-performing loans and unexpected chargeoffs. If $ULLP_{it}$ is good news only when conditioned on ΔNPL_{it} and $ULCO_{it}$, then the estimated coefficient on $ULLP_{it}$ (λ_4) should become negative when the conditioning variables are withheld. Alternatively, if the market interprets $ULLP_{it}$ as good news unconditionally, then the estimate of λ_4 should remain positive.

The results are presented in table 4, panel C. By itself, $ULLP_{it}$ is negatively related to returns. The estimate of λ_4 switches from positive to negative, although it is statistically insignificant. Individually, ΔNPL_{it} and $ULCO_{it}$ are also negatively related to returns. The magnitudes and significance of the coefficients on ΔNPL_{it} and $ULCO_{it}$ are less than those obtained when all three disclosures are examined jointly.

Investors appear to interpret all three loan loss disclosures jointly. In particular, investors appear to interpret $ULLP_{it}$ as “good news” only when they can condition on ΔNPL_{it} and/or $ULCO_{it}$. This result suggests that investors use unexpected changes in non-performing loans and unexpected loan chargeoffs to infer whether managers’ are exercising discretion over reported loan loss provisions. These findings support the information-based explanations.

¹⁸ The results in Beaver et al. (1989) can also be observed in this larger sample and longer study period. Results of separate tests suggest that levels of non-performing loans are negatively related to bank market values, while levels of loan loss allowances are positively related to bank market values (Wahlen 1991).

¹⁹ These specifications include re-estimating equations (7) and (8): (a) withholding the highest and lowest percentiles of the distribution of $ULLP_{it}$ from the sample (to check for effects of outliers); (b) using the change in dividends and the change in earnings in place of the levels of those variables (to allow for the possibility that dividends and earnings of banks may follow a random walk); and (c) withholding the observations from 1987 that include the large loan loss provisions relating to certain banks’ foreign loan portfolios. In fact, the coefficient estimates on the three loan loss variables and their levels of statistical significance actually increase in response to these specification tests.

VII. Tests of Market Reactions

This section tests whether stock prices react when banks disclose non-performing loans, loan loss provisions and loan chargeoffs. If investors view the discretionary components of unexpected provisions as indicators of bank managers' private information, then the market should react positively to unexpected provisions when they are released. Ideally, a test of market reactions would use the precise release date of each disclosure by each bank, but unfortunately, historical data on specific release dates for each loan loss disclosure are not available. Most, but not all, banks in the quarterly sample first released the three loan loss disclosures with quarterly earnings announcement press releases. For a minority of the banks in this sample, the release of the financial statements represents the first release of the three loan loss disclosures.²⁰ Since it is not feasible to specify precisely release dates of each loan loss disclosure for each bank, the following analyses examine stock price behavior around both earnings announcement dates and financial statement release dates. These tests are clearly noisy due to event date specification error.

Investor reactions to unexpected loan loss information announced with earnings are estimated using returns cumulated over three days centered on the earnings announcement date. The equation to be estimated is:

$$R_{Aiq} = a_i + b_i R_{FMq} + c_1 \frac{E_{iq}}{MV_{iq-1}} + c_2 \frac{\Delta E_{iq}}{MV_{iq-1}} + c_3 \Delta NPL_{iq} + c_4 \Delta ULLP_{iq} + c_5 \Delta ULCO_{iq} + u_{liq} \quad (9)$$

where: R_{Aiq} denotes returns for bank i , quarter q , cumulated from day -1 through day +1 relative to the earnings announcement date; R_{FMq} is the contemporaneous index of daily returns to the S&P Financial 40; ΔNPL_{iq} , $\Delta ULLP_{iq}$, and $\Delta ULCO_{iq}$ denote unexpected change in non-performing loans, unexpected loan loss provisions and unexpected chargeoffs, scaled by the market value of equity at the beginning of the quarter (MV_{iq-1}); E_{iq} denotes earnings; and u_{liq} is a mean zero error term.

Three-day returns centered on the earnings announcement date are examined to isolate market reactions to loan loss disclosure announcements from other events. Quarterly earnings and changes in quarterly earnings, scaled by market value, are included in equation (9) to control for the time-series processes in quarterly bank earnings and to capture unexpected earnings information released during the event window.²¹

Equation (9) is estimated over the pooled quarterly sample, and the results are reported in table 5, panel A. The results suggest the market reacts positively to unexpected provisions and earnings at the earnings announcement date. The coefficient on the change in earnings is positive but insignificant. In contrast, the coefficient on unexpected chargeoffs is negative and the coefficient on unexpected changes in non-performing loans is zero.²²

²⁰Quarterly earnings were announced an average of 13 trading days after the end of the quarter during this study period. Bank 10Qs were released an average of 18 trading days after first, second and third quarter earnings announcements. Bank 10Ks were released an average of 42 trading days after fourth quarter earnings were announced.

²¹Equation (9) includes both earnings and changes in earnings because levels of quarterly earnings scaled by market value are positively autocorrelated ($\rho=0.257$ ($p<.01$) at lag -1), while changes in quarterly earnings scaled by market value are negatively autocorrelated ($\rho=-0.575$ ($p<.01$) at lag -1). Neither variable appears to be seasonally autocorrelated. Results are qualitatively similar, however, whether equation (9) is estimated with earnings or changes in earnings or both. Easton and Harris (1991) provide prior evidence on the use of both levels and changes in earnings to control for the time-series process in earnings.

²²BancTexas Group experienced financial distress during 1986-1987, requiring substantial FDIC assistance and new management. During this period, this bank announced six unusually large negative quarterly earnings. These observations have an undue influence on this test, even when they are winsorized. The results reported throughout this section are based on a sample that excludes these unusual cases. Conventional influence diagnostics indicate no other outliers exist in this sample.

Table 5
Stock Price Reactions to Unexpected Loan Loss Disclosures
at Earnings Announcement Dates

This table presents estimates of stock price reactions to earnings and loan loss information during three days centered on earnings announcement dates. These reactions are estimated using the pooled quarterly sample (86 banks over 1984:4 - 1989:3).

$$R_{Aiq} = a_i + b_i R_{FMq} + c_1 \frac{E_{iq}}{MV_{iq-1}} + c_2 \frac{\Delta E_{iq}}{MV_{iq-1}} + c_3 U\Delta NPL_{iq} + c_4 ULLP_{iq} + c_5 ULCO_{iq} + u_{liq} \quad (9)$$

Coefficients:	a_i	b_i	c_1	c_2	c_3	c_4	c_5
Predicted Signs:	—	—	+	+	-	+	-

PANEL A: Market reactions to earnings, changes in earnings, unexpected changes in non-performing loans, unexpected loan loss provisions and unexpected loan chargeoffs.

Coefficients:	—	—	.037	.019	.006	.059	-.115
(t-statistics):			(2.1)	(1.3)	(0.7)	(3.0)	(-4.2)
N= 1519 Adj. R ² = 0.465							

PANEL B: Reactions to earnings, changes in earnings, unexpected changes in non-performing loans, unexpected loan loss provisions and unexpected loan chargeoffs, estimated with the full sample excluding the upper and lower 1% of the distribution of each unexpected loan loss variable.

Coefficients:	—	—	.054	.011	-.073	.008	-.232
(t-statistics):			(1.9)	(0.6)	(-4.0)	(0.3)	(-5.0)
N= 1462 Adj. R ² = 0.508							

Notes to table 5:

R_{Aiq} = returns for bank i , quarter q , cumulated from day -1 through day +1 relative to the earnings announcement date;

R_{FMq} = contemporaneous index of daily returns to the S&P Financial 40;

E_{iq} = earnings over the market value of equity at the beginning of quarter q (MV_{iq-1});

$U\Delta NPL_{iq}$, $ULLP_{iq}$, and $ULCO_{iq}$ denote estimates of the unexpected change in non-performing loans, unexpected loan loss provisions, and unexpected loan chargeoffs, respectively, all scaled by the market value of equity at the beginning of quarter q (MV_{iq-1}).

As a check on the influence of extreme observations on these results, equation (9) is re-estimated excluding all of the observations in the upper and lower one percent of the distributions of each unexpected loan loss variable (a total of 57 observations). The results are presented in table 5, panel B. These coefficients suggest that the market reacts positively to earnings, and negatively to both unexpected changes in non-performing loans and unexpected chargeoffs at the earnings announcement date. In contrast, reactions to unexpected provisions and changes in earnings are positive but statistically insignificant.

Stock price reactions are also examined using three-day returns centered on the date stamped "Received" by the SEC on the 10Q or 10K. The estimation equation is similar to equation (9), except earnings and changes in earnings are not included in this test because this information is usually announced prior to the release of the financial statements. The results (not reported) do not reflect significant reactions to unexpected loan loss disclosures at financial statement release dates. All of the coefficients on the unexpected loan loss variables have the predicted sign but all are insignificant. The lack of detectable reactions at the financial statements release date is likely attributable to the early release of loan loss information with earnings.

The earnings announcement date results are consistent with the notion that investors react positively to unexpected provisions as if they convey private information of managers, but only in cases when unexpected provisions are unusually large. These findings also make it less likely that the positive relation between unexpected provisions and returns is caused by an omitted variable or other research design flaw.²³

VIII. Conclusions

A key component of bank stock valuation is the assessment of default risk inherent in the loan portfolio. Commercial bank financial statements provide three related but distinct disclosures of loan portfolio default risk: changes in non-performing loans, loan loss provisions and loan chargeoffs. These disclosures span the income statement, the balance sheet, and the footnotes. They provide an opportunity to examine a richer context of disclosure than has generally been addressed in accounting-based capital markets research. This study analyzes the information each of these three disclosures reveals about the future performance of a bank, and the impact of this information on bank stock prices.

Several results emerge. Bank managers appear to increase the discretionary components of reported loan loss provisions when future cash flow prospects improve. Unexpected provisions are positively related to future changes in cash flows as far as three years ahead, given current cash flows, unexpected changes in non-performing loans and unexpected loan chargeoffs. Annual returns and earnings announcement date stock price reactions confirm that investors interpret discretionary components of unexpected provisions as "good news" about future changes in cash flows, even though provisions are measures of expected losses that reduce current earnings.

Unexpected changes in non-performing loans and unexpected loan chargeoffs are found to be key pieces of additional information about expected future loan losses. Each is negatively related to future changes in cash flows and to both annual returns and earnings announcement date

²³ The results in this section are robust to various sensitivity tests. For instance: (A) Similar results obtain when the unusually large changes in non-performing loans and loan loss provisions for foreign loans in 1987 are withheld from the sample. (B) The results are also unchanged when equation (9) is estimated with a combined returns metric, cumulating returns around both earnings announcement and financial statement release dates. (C) Following the suggestions of several analysts, equation (9) was also estimated allowing the coefficients on the loan loss variables to vary by bank size. F tests fail to reject the null of equal coefficients across banks of different size.

stock price reactions. These relatively nondiscretionary measures of loan losses appear to enable investors to observe when managers are exercising discretion with respect to reported provisions. Unexpected provisions are “good news” only when conditioned on unexpected changes in non-performing loans and unexpected chargeoffs. Specifically, the relations between unexpected provisions and both returns and future cash flows are positive only when unexpected changes in non-performing loans and unexpected chargeoffs are included in the analysis.

This study contributes new evidence on management discretion with respect to financial reporting and its impact on capital markets. The research demonstrates a context in which the market’s interpretation of a component of income is conditioned on related disclosures found on the balance sheet and in the financial statement footnotes. The results also contribute additional evidence that balance sheet and footnote disclosures have information content. The evidence presented here on the value-relevance of loan portfolio default risk disclosures perhaps will contribute to the ongoing debate regarding recognition versus disclosure of fair value information on investment security and loan portfolios (e.g., FAS 107).

The empirical tests in this study focus on whether managers exercise discretion and increase reported provisions when future cash flows are expected to increase, and whether investors interpret unexpected provisions as if they convey managers’ private information. This study does not directly address the question of why managers might choose to increase provisions when future cash flows prospects improve. The evidence presented here suggests that increased unexpected loan loss provisions are interpreted as “good news,” consistent with the signalling literature (e.g., Akerlof 1970; Spence 1973; Grossman 1981; Milgrom 1981). The findings are also consistent with the effects of reputation on information asymmetry (e.g., Kreps and Wilson 1982; Milgrom and Roberts 1982), and models in which investors assign values to firms on the basis of their financial reporting reputations (e.g., Teoh and Hwang 1991; Healy and Palepu 1993). Reputation effects and signalling models warrant further consideration as potential bases for future tests of explanations for bank managers’ loan loss provision reporting decisions and the positive relation between unexpected provisions and returns.

References

- Akerlof, G. 1970. The market for ‘lemons’: Quality uncertainty and the market mechanism. *Quarterly Journal of Economics* 89 (August): 488–500.
- Antle, R., J. Demski, and S. Ryan. 1993. Multiple sources of information, valuation and accounting earnings. Forthcoming, *Journal of Accounting, Auditing and Finance*.
- Barth, M., W. Beaver, and C. Stinson. 1991. Supplemental data and the structure of thrift share prices. *The Accounting Review* 66 (January): 56–66.
- Beatty, A., S. Chamberlain, and J. Magliolo. 1993. Managing financial reports of commercial banks: The influence of taxes, regulatory capital, and earnings. Working paper, University of Pennsylvania, Philadelphia, PA.
- Beaver, W., C. Eger, S. Ryan, and M. Wolfson. 1989. Financial reporting, supplemental disclosures, and bank share prices. *Journal of Accounting Research* 27 (Autumn): 157–178.
- Bernard, V. 1987. Cross-sectional dependence and problems in inference in market-based accounting research. *Journal of Accounting Research* 25 (Spring): 1–48.
- Brennan, M. 1991. A perspective on accounting and stock prices. *The Accounting Review* 66 (January): 67–79.
- Collins, J., D. Shackelford, and J. Wahlen. 1993. The coordination of regulatory capital, earnings, and taxes for banks. Working Paper, University of North Carolina at Chapel Hill, Chapel Hill, NC.
- Easton, P., and T. Harris. 1991. Earnings as an explanatory variable for returns. *Journal of Accounting Research* 29 (Spring): 19–36.
- Elliott, J., J. D. Hanna, and W. Shaw. 1991. The evaluation by the financial markets of changes in bank loan loss reserve levels. *The Accounting Review* 66 (October): 847–861.

- Griffin, P., and S. Wallach. 1991. Latin American lending by major U.S. banks: The effects of disclosures about nonaccrual loans and loan loss provisions. *The Accounting Review* 66 (October): 831–847.
- Grossman, S. 1981. The informational role of warranties and private disclosure about product quality. *Journal of Law and Economics* 24: 461–483.
- Healy, P., and K. Palepu. 1993. The effect of firms' financial disclosure strategies on stock prices. *Accounting Horizons* Vol. 7, No. 1: 1–11.
- Johnson, W. B. 1989. Asset impairment, disclosure policy and stock prices: The valuation of problem foreign loans by commercial banks. Working Paper, University of Iowa, Iowa City, IA.
- Keefe, Bruyette, and Woods. 1977–1988. *Bank Book*.
- Kreps, D., and R. Wilson. 1982. Reputation and imperfect information. *Journal of Economic Theory* 27: 253–279.
- Milgrom, P. 1981. Good news and bad news: Representation theorems and applications. *Bell Journal of Economics* 12: 380–391.
- , and J. Roberts. 1982. Predation, reputation and entry deterrence. *Journal of Economic Theory* 27: 280–312.
- Moyer, S. 1990. Capital adequacy ratio regulations and accounting choices in commercial banks. *Journal of Accounting and Economics* 13 (July): 123–154.
- Ohlson, J. 1988a. A synthesis of security valuation theory and the role of dividends, cash flows and earnings. Working Paper, Columbia University, New York, NY.
- . 1988b. Accounting earnings, book value, and dividends: The theory of the clean surplus equation. Working Paper, Columbia University, New York, NY.
- . 1989. The theory of value and earnings, and an introduction to the Ball-Brown analysis. Working Paper, Columbia University, New York, NY.
- Scholes, M., P. Wilson, and M. Wolfson. 1990. Tax planning, regulatory capital planning, and financial reporting strategy for commercial banks. *Review of Financial Studies* Vol. 3, No. 4: 625–650.
- Spence, A. M. 1973. Job market signalling. *Quarterly Journal of Economics* 87: 355–379.
- Teoh, S. H., and C. Y. Hwang. 1991. Non-disclosure and adverse disclosure as signals of firm value. *Review of Financial Studies* Vol. 4, No. 2: 283–314.
- Wahlen, J. 1991. The nature of information in commercial bank loan loss disclosures. PhD. Dissertation, University of Michigan, Ann Arbor, MI.

Product Costing and Pricing

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SYNOPSIS AND INTRODUCTION: Recently, management accountants have focussed attention on the appropriate treatment of costs associated with resources committed to support activities which do not vary proportionally to production once initial capacities have been set. In one typical case, it is assumed that costs of committed resources will be incurred irrespective of actual usage, and increasing initial capacities to accommodate unexpected demand involves penalties above *normal* costs. There are at least two important issues that arise in such a case: (1) how should costs of resources committed to, or subsequently required by, support activities enter into pricing and capacity decisions, and (2) what information should the accounting system provide to marketing and production in order to implement those decisions.

Our objective in this paper is to address these two issues. The basic tension which underlies both pricing and capacity decisions is between the nonrecoverable cost of adding capacity before demand becomes known, and the expected penalty-adjusted cost of doing so after demand becomes known. In regard to the first issue, we find in our setting that only normal cost enters into pricing rules established at the time initial capacities are set. (Penalties for exceeding initial capacities are implicit in that for the marginal unit of each activity, normal cost equals expected penalty-adjusted cost.) Findings on the second issue are that the product costing system can be designed without knowledge of demand parameters; the marketing manager only requires *activity-based* unit costs provided by that system, along with knowledge of demand parameters, to make pricing decisions which are optimal from a firm-wide standpoint; and the production manager only needs expected demand from marketing, along with knowledge of the distribution of random demand shocks, and cost and production parameters, to make initial capacity decisions.

The *economic sufficiency* of the activity-based unit cost in pricing decisions is in the spirit of Amershi et al. (1989), while the equivalence of marginal cost, normal cost,

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and expected penalty-adjusted cost of under-capacity bear similarity to results in studies by Miller and Buckman (1987), Whang (1989) and Hansen and Magee (1993). The main distinctions between these studies and ours lie in assumptions regarding production functions, the nature of information asymmetries, and our incorporation of pricing decisions as well as capacity decisions.

Key Words: *Activity-based unit costs, Normal costs, Cost drivers, Practical capacity, Overhead rates, Decentralization.*

THE body of the paper is organized as follows: section I provides some brief background and a more in-depth overview of our principal findings; section II sets forth our basic assumptions and definitions for various components of the cost and demand functions; section III examines the optimal pricing and capacity decisions of a centralized monopolist firm; section IV depicts minimal information flows sufficient to implement those decisions in a decentralized firm; and section V concludes the paper.

I. Background and Overview

Reporting product costs to managers faced with pricing decisions is an important task of management accountants. This task often involves assigning costs of support activities which do not vary proportionally with production once initial capacities of those activities have been set. Modern prescriptions for assigning costs of support activities to units of production (such as Cooper and Kaplan's (1987) call for assignment based on relative use, so-called *activity-based costing*) do not specify the precise correspondence of costs to prices, the efficacy of relying on assigned costs in making pricing decisions, the information required by accountants in designing product cost systems, or the information required by marketing managers in implementing pricing policies. Accordingly, there is a need for accounting research which addresses these aspects.¹

The setting we employ for examining relationships between support activity costs and prices is akin to the classic newsboy problem. Principal departures have to do with our relaxation of constraints on capacities to meet excess demand and our attention to pricing as well as capacity decisions. In particular, we consider a case in which pricing decisions and initial commitments of resources to support activities are made before uncertain demand is realized. Costs of support activities are *fixed* in the sense that they are incurred even if committed resources are not fully utilized when production required to meet demand is low.² When production required to meet demand is high, constraints implied by committed resources can be relaxed only at an incremental cost in excess of the *normal cost* of contracting for them in advance of usage. Such incremental

¹ The National Association of Cost Accountants, a predecessor of the present Institute of Management Accountants, prescribed in an April 1953 bulletin: "Judgment and understanding is required in using marginal costs for pricing purposes. It is necessary to consider long range aspects of such business in order to avoid commitments which cannot be dropped. ... Supplementary allocation of fixed overhead on normal or other volume base must be made to provide product costs for long range planning decisions."

² This representation of support activity commitments falls in the category of resources supplied in advance of usage discussed by Cooper and Kaplan (1992) and Kaplan (1993). Key elements are that the costs of committed resources will be incurred irrespective of actual usage, and that obtaining support activity resources in excess of initial capacities involves higher than normal costs. As noted later, the essential feature of costs considered is that they vary with costs driver capacities rather than with actual production.

costs arise because of overtime premiums and other costs of arranging for additional resources on short notice.

The first part of our analysis considers the manner in which the costs associated with support activities are aggregated in the functional relationship between costs and optimal prices. The next part considers whether activity-based unit costs provide sufficient cost and production information to permit decentralization of pricing decisions to marketing managers who know or learn demand functions, but nothing more. We find sufficient conditions for optimal prices to incorporate the fixed costs of resources committed to support activities *as if* those costs were variable production costs. However, this apparently simple relationship between optimal prices and fixed costs is deceptive in that the relationship between the sunk costs of unused overcapacity from such commitments and the penalties for undercapacity are not evident in the pricing function, even though the tradeoff between these two plays an important role in its determination through concurrent support activity resource commitment decisions. These aspects are brought out in the derivation of this function.³

More notably, we find that the sum of unit support activity costs weighted by the number of units of activity required to support a unit of output is sufficient to convey all information concerning support activities relevant for the pricing decisions. In the parlance of Amershi et al. (1989), this sum is *economically sufficient* with respect to pricing decisions; Demski and Feltham (1976) refer to it as a *sufficient cost statistic*.⁴ Given a decentralized firm, activity-based costing provides an aggregate product cost measure which conveys all the cost and production information that the marketing manager requires to make optimal pricing decisions. The marginal value of more detailed variable cost and normal cost information, conditional on the availability of the activity-based unit cost, is zero for both pricing and capacity decisions.

Miller and Buckman (1987) consider conditions under which full or variable costing better approximate opportunity costs of a service department when the department can be characterized as a queuing system. Allocation of fixed costs is considered (as in our model) in conjunction with a capital budgeting problem. Their formulation also provides for idle capacity due to stochastic demand. Their result, that marginal cost and allocated cost of full capacity are the same when cost of capacity is linear, parallels our result on the equivalence of marginal cost and normal cost in that one can interpret normal cost as the allocated cost of (full) capacity set *ex ante*. However, the distinguishing aspect of our analysis is that optimal prices depend on penalties for exceeding capacity only indirectly through the equality of normal cost with expected penalty-adjusted cost,

³ Formalization of this relationship between product costs and pricing decisions is also useful in assessing conventional accounting practices for determining support activities overhead rates. For example, the practice of dividing expected costs by the expected level of support activities results in rates that may differ from the per unit cost of support activities imbedded in optimal prices. Some issues relevant to the ABC debate which we do not address in this study include cost pool identification, tradeoffs between volume and nonvolume cost drivers, uncertainty in input-output mappings (a Leontief structure is assumed throughout) and dynamic behavior in demand.

⁴ It is this economic sufficiency of activity-based unit costs that distinguishes our contribution from an earlier generation of cost allocation studies such as those by Kaplan and Thompson (1971), and Kaplan and Welam (1974). In those studies, suitable allocations were determined as part of the solution to a specific production planning problem that required the knowledge of the detailed information aggregated later in the allocations. Since the detailed information was required to solve the production problem, the computation of the allocations did not create value to the organization by reducing its information requirement. In contrast, we show that an activity-based unit cost aggregates all production and cost information relevant to the pricing decision, *a priori*, and the aggregation function does *not* require the solution of either a production or a pricing problem. The aggregation procedure can be specified before learning about the demand, production or cost parameters.

even though initial capacity decisions depend directly on the penalty parameters. There is no analogous result in Miller and Buckman since they do not consider a pricing decision.⁵

Whang (1989) adds an incentive conflict between users of a resource and the resource manager. This conflict arises from an information asymmetry and self-interest of the users and manager. The manager seeks to elicit demand information from users both to set capacity of the resource and to allocate that capacity. Given a linear cost function, as well as an ability of the manager to commit not to use reports by users on the value of the service, he shows that (full) cost allocation induces truthful revelation and *ex post* efficiency in allocating capacity. While our analysis provides for information asymmetries from decentralization, we do not consider the incentive conflicts which might then be present.

Finally, Hansen and Magee (1993) consider a setting in which a manager knows the number of projects which may be submitted by users but not the (random) incremental benefit of each project. The manager must choose capacity and a constant cost rule for charging out units of capacity before observing project submissions. Projects are accepted if their incremental benefits exceed this predetermined cost. When the number of projects is large and capacity costs are linear, this rule is optimal in that it implies that unit costs of capacity correspond to the expected incremental benefits of the marginal project.

Similar to the standard newsboy problem, once capacity is set in these studies, it is not possible to adjust that capacity to meet subsequently determined demand.⁶ The environment in our model differs in that capacity can be increased as necessary to meet demand when demand becomes known, albeit at a cost penalty. Since (by assumption) it is always to be optimal to meet demand, there are no lost sales. Rather, the marginal cost of adding initial capacity is equated to the expected penalty-adjusted cost of exceeding initial capacity; i.e., the benefit of adding another unit of initial capacity is in avoiding the penalty associated with adding capacity after demand becomes known. Optimal prices are set simultaneously with initial capacities of support activities, so they need consider only the normal cost of adding capacity. The penalties for exceeding that capacity need not be explicitly considered in pricing. Of course, the results just described are just as relevant for a single product and single activity as they are in the more complex multiproduct, multiactivity production function assumed in our analysis.⁷

II. Structure of Costs and Demand

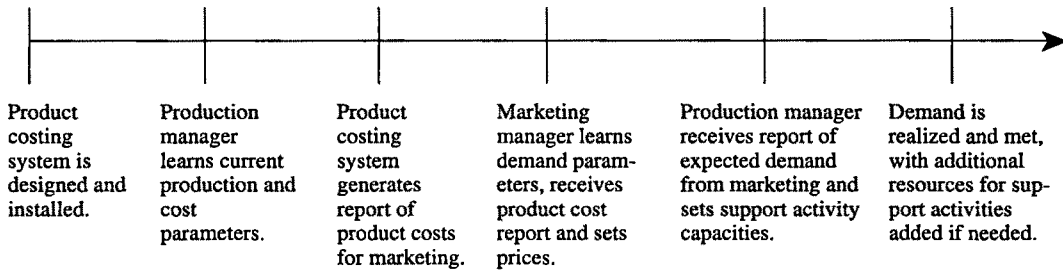
We model a monopolist firm which produces multiple products that require multiple activities to support their production. We consider a decentralized organization comprised of a marketing manager and a production manager. The product costing system is designed first, before detailed information on production, cost or demand parameters is available. Information is aggregated in accordance with the *ex ante* design of the system. The marketing manager chooses product prices and the production manager decides the capacities for support activities, based on information available to them. Figure 1 presents a time line of these events.

⁵ There is a similarity between their results that the marginal cost of capacity equals the value of incremental productivity and our result that marginal cost equals the expected savings of penalty-adjusted cost when capacity is exceeded. The principal distinction lies in the endogeneity of price in our model.

⁶ The issue is moot in Whang since demand information is acquired by the manager before capacity is chosen.

⁷ Another way of making the point is to say that the insight is sustained by linear production not limited to single product/activity settings.

Figure 1
Time Line of Events



The principal question we seek to resolve is whether the aggregation of cost information as in an activity-based cost system will provide the relevant information for the pricing decisions which follow. We address this question by showing how costs enter the optimal solution of both the pricing and capacity problems when all information and decisions are centralized. Subsequently, we show that decentralized decisions using activity-based unit costs result in the same decisions (and therefore, the same expected profit) as those made by a central decision maker having access to all detailed information. Toward this end, we begin by considering a centralized organization in which all information depicted in figure 1 is available to a single individual, who makes all the decisions. We defer the consideration of a decentralized organization with multiple decision makers until section IV.

For now, we assume demand for each product is linear in its price and includes an additively separable stochastic component. Specifically, derived demand functions are defined as follows:

$$q_j = \alpha_j - \beta_j p_j + \varepsilon_j, \quad j=1, \dots, J, \quad (1)$$

where p_j and q_j represent prices chosen by the firm and quantities demanded by customers, respectively, α_j and β_j are positive parameters ($\alpha_j, \beta_j > 0$) whose values are learned after the design of the cost system but before the pricing and capacity decisions, and ε_j are random disturbances with $E(\varepsilon_j) = 0$ that represent the uncertainty about demand remaining after these decisions are made. The cost and demand parameters, and the lower supports of ε_j distributions are assumed to be such that $q_j > 0$ for all $j=1, \dots, J$ under optimal price choices. We will also use the vector notation $\mathbf{p} \equiv (p_1, \dots, p_J, \dots, p_J)$, $\mathbf{q} \equiv (q_1, \dots, q_J, \dots, q_J)$.

Let $C(\mathbf{x}, \mathbf{q})$ denote a cost function which incorporates both variable and fixed costs of production including costs of support activities, where $\mathbf{x} \equiv (x_1, \dots, x_I, \dots, x_I)$ represents a vector of *activity cost driver capacities* implied by resources committed to activities $i=1, \dots, I$. The cost accounting literature is ambiguous about the differentiation between variable and fixed costs in how they relate to activity cost drivers. Our definitions presented below reflect assumptions about commitment and usage of resources that underlie activity-based costing (Cooper and Kaplan 1992).

We define total costs of production as follows:

$$C(\mathbf{x}, \mathbf{q}) = \sum_{j=1}^J v_j q_j + \sum_{i=1}^I m_i x_i + \sum_{i=1}^I \xi_i(x_i, \mathbf{q}), \quad (2)$$

where

$$\xi_i(x_i, q) = \begin{cases} 0, & \text{if } \sum_{j=1}^J \mu_{ij} q_j \leq x_i \\ \theta_i m_i (\sum_{j=1}^J \mu_{ij} q_j - x_i), & \text{if } \sum_{j=1}^J \mu_{ij} q_j > x_i \end{cases}$$

and

v_j $\equiv$ variable cost per unit of product j ,

m_i $\equiv$ *normal cost* per unit of cost driver for activity i ,

θ_i $\equiv$ factor to reflect penalty for exceeding cost driver resources committed to activity i ,
 $\theta_i > 1$, and

μ_{ij} $\equiv$ number of units of activity i required to support one unit of product j .

The first term on the right hand side (RHS) of (2) represents variable costs for resources which are supplied as used; the second term is the fixed cost of committed resources which will be incurred irrespective of whether capacities are fully utilized; and the third term is the penalty incurred contingent on whether initial capacities of support activities implied by those commitments are exceeded in order to meet demand.⁸ Note that the three components of $C(x, q)$ have different cost drivers: variable costs of production are driven by outputs, normal costs of support activities are driven by the levels of cost driver capacities fixed for those activities, and penalties for exceeding initial capacities are driven by both outputs and cost driver capacities.⁹ This structure is consistent with Walters' (1963) econometric survey which indicates that cost functions are approximately linear until capacity is reached, but marginal costs increase sharply once capacity is exceeded.

The pattern of managers committing to make resources available to support production, in advance of knowing precisely how much will be used, characterizes many if not most activities performed in an organization. Such activities include purchasing, receiving, stores, materials handling and moving, scheduling, machine setup, maintenance, janitorial services, quality inspection and engineering support and may constitute a large proportion of total costs (Miller and Vollman 1985; Banker et al. 1992). What we and others term the normal costs of such activity resources are usually labelled as fixed costs in textbooks because they must be incurred once the initial capacity commitments are made regardless of whether such resources remain idle or unused during the period. The essential feature of these costs is that they do not vary with actual production, but rather vary with the cost driver *capacities*.

For instance, suppose a plant employs ten workers responsible only for performing quality inspections. A fixed proportion of all production is inspected on a sampling basis. Quality inspection costs, however, are *not* variable costs. Each worker can perform 800 inspections per month. By hiring the ten quality inspectors at fixed monthly wages and benefits of \$4,000 per

⁸The usual activity-based costing model includes both volume-related and batch-related activity costs. While the latter costs are likely step costs, suggesting an integer programming optimization problem, with our well-behaved cost and revenue functions, we assume that optimal solutions obtained treating them as continuous functions yield good approximations for large q_j and x_i . Product-sustaining costs may also be included by defining activities that correspond to individual products. Such costs are not relevant for decisions in our model, however, because we assume $q_j > 0$ for all j .

⁹ Variable costs correspond to resources whose consumption can be adjusted to match precisely the quantities required by actual production. Direct materials are variable costs because materials are consumed in proportion to current production. Costs of electrical power to operate machines, commissions to sales personnel based on actual sales, and piece-rate direct labor costs are other common examples of variable costs. Direct labor hired on a weekly, monthly or some other time basis, however, must be paid their wages for the period even if they are idled by lack of work. Such direct labor costs do not vary with production in the short run.

worker, the plant commits to spend \$40,000 to make available resource capacity for $x_i = 8,000 (=800 \times 10)$ quality inspections a month. The *normal cost* per inspection is $m_i = \$5 (=40,000/8,000)$.

In addition to the normal costs of support activities, there are the costs of additional resources that may be required in case initially committed activity levels are not adequate to support actual production needs. Let z_i denote the usage of activity i implied by actual production $\mathbf{q}$. Therefore, the total number of units of support activity i required for the production of q_j units of all $j=1, \dots, J$ products is

$$z_i = \sum_{j=1}^J \mu_{ij} q_j.$$

The activity-based costing model assumes that activity cost resource usage $\mathbf{z}$ varies with actual production $\mathbf{q}$, but its total normal cost

$$\sum_{i=1}^I m_i x_i$$

varies with the committed cost driver levels $\mathbf{x}$ and not production volume $\mathbf{q}$. Additional definitions which will prove useful for our later analysis include:

$$\bar{q}_j \equiv E(q_j | p_j) = \alpha_j - \beta_j p_j, \bar{z}_i \equiv \sum_{j=1}^J \mu_{ij} \bar{q}_j, \text{ and } y_i \equiv \sum_{j=1}^J \mu_{ij} \varepsilon_j, \text{ so that } z_i = \bar{z}_i + y_i.$$

Hence, $\bar{q}_j$ is the expected demand for product j and $\bar{z}_i$ is the demand for support activity i induced by expected demand for all products $j=1, \dots, J$. A marginal distribution of each y_i can be induced as a convolution of the distributions of the ε_j 's; let $\phi_i(y_i)$ and $\Phi_i(y_i)$ denote the probability density and distribution functions, respectively.

If the actual demand for support activity i is less than available capacity (i.e., $z_i < x_i$ or equivalently $y_i < x_i - \bar{z}_i$), then the surplus resources expire unused and the total cost of activity i remains at $m_i x_i$. If the actual demand for support activity i exceeds available capacity (i.e., $y_i > x_i - \bar{z}_i$), then an additional cost of $\theta_i m_i$, $\theta_i > 1$, is incurred for each additional unit of cost driver x_i that is actually consumed.¹⁰ That is, the additional costs when $z_i > x_i$ are $\xi_i(x_i, \mathbf{q}) = \theta_i m_i (z_i - x_i)$, which exceeds the normal costs of additional resources by $(\theta_i - 1)m_i(z_i - x_i) > 0$, and provides the economic rationale for managers to commit in advance rather than waiting to acquire only the precise quantities required after demand for support activities is known with certainty.¹¹ More broadly speaking, we can view the premium per unit paid to expand capacities of support activities such as quality inspection as a differential between costs of advance commitments and costs of contracting in the spot market (Cooper and Kaplan 1992). Other penalty costs associated with delays, queues and congestion resulting from actual demand for support activities exceeding committed resources, are less perceptible (Banker et al. 1988), but also important.

Returning to our example of quality inspections, assume that the plant manufactures three products that are inspected on a sampling basis at the rate of one out of 200, 100 and 80 units of the products respectively, so that $\mu_{11} = 0.005 (=1/200)$, $\mu_{12} = 0.010$ and $\mu_{13} = 0.0125$ inspections per product unit. If actual production is 600,000, 350,000, and 80,000 units, respectively, then $z_1 = 7,500 (=3,000 + 3,500 + 1,000)$ inspections will be required in that month, notwithstanding that

¹⁰ Linear penalties, while somewhat restrictive, are adequate to produce the desired tension between over and under commitments of resources.

¹¹ Observe that with multiple products there is a diversification benefit to having one firm supply support activities for all products provided the stochastic components of demand are not perfectly and positively correlated. The relevant measure in determining when penalties will be incurred in meeting joint demand is an average realization. Thus, even though economies of scope are not included directly in our linear, separable cost model, there is a rationale for multiple products to be housed in a single firm. There are externalities implied by the possibility that high demand for one product could be offset by low demand for another product, thereby reducing the prospect of penalties being incurred in meeting total demands.

capacity for $x_i = 8,000$ inspections was available. In other words, \$40,000 of costs would be incurred even though actual production does not require utilization of all resources made available by that expenditure. Alternatively, if actual production for the third product increased to 200,000, then a total of $z_i = 9,000$ ($= 3,000 + 3,500 + 2,500$) inspections would be required. Assuming that the plant could contract for an additional 1,000 inspections at \$7.50 per inspection (\$5.00 plus a premium of \$2.50), the actual cost of support activities would be \$47,500 even though the cost would have been just \$45,000 if the plant had committed to a capacity for exactly 9,000 inspections in advance.

We define the *activity-based cost* c_j per unit of product j to be

$$c_j = v_j + \sum_{i=1}^I m_i \mu_{ij}, \quad (3)$$

where the costs of support activity resources are assigned to the products based on the per unit requirements μ_{ij} of each product j . Clearly, if demand were certain, then the initial capacity commitments would just meet demand and c_j as expressed in (3) would be the cost actually incurred per unit produced. The interesting question is what role c_j plays in pricing and capacity decisions when demand is uncertain.

III. Pricing and Capacity Decisions

Capacity Decision

Suppose the monopolist firm is centralized and chooses the price of each product j and the level of capacity x_i for each support activity i . Customers respond, and actual demand q_j is realized in accordance with (1). We assume that it is worthwhile for the firm to fill all realized demand.¹² Expected profits conditional on one set of demand and cost function parameters ($\alpha, \beta, m, \theta, v$) can now be stated as follows:

$$E[\pi(x, p) | \alpha, \beta, m, \theta, v] = \sum_{j=1}^J (p_j - v_j) \bar{q}_j - \sum_{i=1}^I m_i x_i - \sum_{j=1}^J \theta_j m_j \int_{x_i - \bar{z}_i}^{\infty} [\bar{z}_i + y_i - x_i] \phi_i(y_i) dy_i \quad (4)$$

The three terms on the RHS of (4) are expected contribution margin, fixed costs of committed resources, and expected penalties for exceeding initial capacities of support activities, respectively.

While prices are set before commitments to support activities in the decentralized setting illustrated in figure 1, it is convenient for analytic purposes to first characterize optimal commitments.¹³ Differentiating (4) with respect to x_i and simplifying yields the following first-order conditions for characterizing the capacity levels implied by optimal commitments, x (henceforth called *optimal capacity*):

$$\partial E[\pi(x, p)] / \partial x_i = -m_i + \theta_i m_i \int_{x_i - \bar{z}_i}^{\infty} \phi_i(y_i) dy_i = 0, \quad i = 1, \dots, I. \quad (5)$$

The two terms on the RHS of (5) reflect the tradeoff between the cost of committing resources sufficient to provide capacity for an additional unit of support activity i , and the expected cost of

¹² We shall note later that this assumption can be expressed in terms of exogenous conditions on cost and demand parameters that ensure that optimal prices exceed the unit production costs even when demand for support activities exceed their capacities.

¹³ The decisions are interchangeable in terms of the order in which they are addressed, since analytically speaking they are made simultaneously.

adding capacity should actual demand for outputs induce a demand for a further unit of that activity, respectively. Note that if there were no uncertainty, then total costs would be minimized by choosing $x_i = z_i$. However, given uncertainty, one would seek to balance overinvestment in capacity when demand is low against penalties incurred when demand is high.

It follows from (5) that

$$1 - \Phi_i(x_i^* - \bar{z}_i) = 1/\theta_i, \quad i = 1, \dots, I. \quad (6)$$

Interpreting (6), we can see that the magnitude of the per unit penalty factor θ_i governs the relationship between optimal capacity of the support activity and the requirements of expected demand. To illustrate, assume that the inverse function Φ_i^{-1} exists, implying that

$$x_i^* = \bar{z}_i + \Phi_i^{-1}\left(1 - \frac{1}{\theta_i}\right). \quad (7)$$

The second term on the RHS of (7) represents capacity dedicated to activity i beyond expected requirements. Since the actual utilization of that capacity depends on the joint realizations of demand for all J products, it is clear that there is an implicit interdependency across products which, if ignored, would lead to suboptimal decisions.

Further, if $\phi_i(\cdot)$ is symmetric, then Φ_i^{-1} equals zero only when $\theta_i = 2$. Thus, when the penalty for inadequate capacity is sufficiently large ($\theta_i > 2$), the optimal capacity will exceed expected demand for that activity, and when it is sufficiently small ($\theta_i < 2$), the reverse will be true. More generally, we can observe that

$$\frac{dx_i^*}{d\theta_i} = \left(\frac{1}{\phi_i(x_i^* - \bar{z}_i)}\right)\theta_i^2 > 0, \quad (8)$$

which reflects the intuitively appealing notion that optimal capacity increases with the penalty (θ) for inadequate capacity.

Pricing Decision

Differentiating (4) with respect to p_j and simplifying, we next obtain the following first-order conditions characterizing the optimal product prices:¹⁴

$$\begin{aligned} \partial E[\pi(\mathbf{x}, \mathbf{p})] / \partial p_j &= \bar{q}_j - (p_j - v_j)\beta_j + \sum_{i=1}^I \theta_i m_i \mu_{ij} \beta_j \int_{x_i - \bar{z}_i}^{\infty} \phi_i(y_i) dy_i \\ &= 0, \quad j = 1, \dots, J. \end{aligned} \quad (9)$$

As the RHS of (9) illustrates, an optimal price balances the marginal loss in contribution margin from increasing price evident in the first two terms, against the marginal expected reduction in penalties for exceeding optimal capacities of support activities contained in the third term. Alternatively, $\bar{q}_j - p_j \beta_j$ represents the marginal revenue lost from an increase in price, while

$$v_j \beta_j + \sum_{i=1}^I \theta_i m_i \mu_{ij} \Phi_i(x_i - \bar{z}_i)$$

represents the expected marginal cost savings from such a change.

¹⁴ Given our assumptions that initial committed capacity can be expanded at a penalty and that realized demand is always met, then solutions to both the capacity and pricing decisions are interior and fully characterized by (5) and (9).

If it were certain that demand would not exceed capacities, then (9) would imply an optimal price $p_j^* = (\alpha_j / 2\beta_j) + (v_j / 2)$. Costs of resources committed to support activities would not enter the determination of prices because of surplus capacity. If the demand were certain to exceed all capacities, then (9) would imply an optimal price

$$p_j^* = (\alpha_j / 2\beta_j) + (v_j + \sum_{i=1}^I \theta_i m_i \mu_{ij}) / 2.$$

Penalty costs for exceeding all capacities would now enter the optimal prices.

In general, the expected cost of incurring penalties for exceeding capacities must be considered in optimal prices. This expected cost is optimally traded off against the *ex ante* cost of activity capacity as in (5). Therefore, rearranging the terms in (9) and making use of (3), (6) and the definition of $\bar{q}_j$ yields the following optimal prices:

$$p_j^* = A_{0j} + A_{1j}c_j, \quad j = 1, \dots, J, \quad (10)$$

where $A_{0j} \equiv \alpha_j / 2\beta_j$ and $A_{1j} = 1/2$. Thus, given the knowledge of the demand parameters (α_j, β_j) , the optimal price of each product is a function only of its activity-based cost c_j .¹⁵ That is, the optimal price does not depend on parameters $\{v_j, m_i, \mu_{ij}\}$ other than through c_j .

More remarkable is that optimal prices given by (10) are indistinguishable from the monopoly prices which would be chosen if all resources were supplied as used, i.e., if there were no penalties for exceeding initial capacities (i.e., $\theta_i = 1$).¹⁶ With no penalties, firms can make all costs variable and avoid fixed costs of overcapacities by committing initial capacities of zero and simply providing the resources needed to meet demand when demand becomes known. Alternatively, if there were no uncertainty, then capacities would be initially set at precisely the levels required of known demand and the penalties would never be incurred. The interesting aspect is that even under uncertainty, when prices and initial capacities are set simultaneously, the penalties do not enter explicitly into optimal prices but rather implicitly through the interdependency of pricing and capacity decisions. The penalties are relevant to setting initial capacities given optimal pricing. However, once capacities are set then prices require no further adjustment to capture costs of exceeding those capacities.¹⁷

Economic Sufficiency

The optimal capacity decision represented by the expression in (7) requires additional information on μ_{ij} , Φ_i and θ_i to determine the expected demand on activity resources and the optimal tradeoff for adding an incremental capacity unit at the margin. (The capacity decision does not require detailed information on the variable costs v_j or the normal activity costs m_i .)

¹⁵ Since $q_j = \alpha_j - \beta_j p_j^* = (\alpha_j - \beta_j c_j) / 2 > 0$, it is clear that prices exceed activity based costs (i.e., $p_j^* > c_j$). It can also be seen that $\beta_j(A_{0j} - A_{1j}c_j) + L_j > 0$, where L_j is the lower support of the distribution of ε_j , ensures that $q_j > 0$ for optimal price choices. In addition, $A_{0j} + A_{1j}c_j > v_j + \sum_{i=1}^I \theta_i \delta_i m_i \mu_{ij}$ ensures that it is optimal for the firm to fill all realized demand. We further note that prices are increasing in the intrinsic worth of the product to the customer as measured by α_j , and decreasing in β_j , the sensitivity of demand to price (Dixit 1979).

¹⁶ Note that although optimal prices are invariant with respect to optimal capacities, optimal capacities depend on prices since they, along with penalties, determine the tradeoff between over-investing in support activities at the outset and incurring extra costs to meet demand if initial capacities are exceeded.

¹⁷ This would not be true if further demand information were obtained after capacities had been set, but before prices were determined. See Banker et al. (1993) for an analysis of this case.

Therefore, for the centralized organization we have considered in this section, the activity-based costs $\{c_j\}$ are *economically sufficient* for the cost parameters $\{v_j, m_i\}$ with respect to *both* the pricing and the capacity decisions. The dimensionality of the information required for these decisions is thus reduced from $J+I$ to only J because of the aggregation.

It is useful at this juncture to contrast our results from those in the cost allocation literature in the early 1970s (e.g. Kaplan and Thompson 1971; Kaplan and Welam 1974). These studies begin with a mathematical programming model of the production process, and use the shadow prices obtained from actually solving the mathematical program to determine the cost allocations. The allocated costs thus constructed using shadow prices are found to be consistent with the optimal solution of the mathematical program. A problem with this approach, however, is that the mathematical program must be solved first using all the detailed information to obtain the cost allocations, and therefore no informational saving or value in supporting the production decisions is generated by the computation of these allocations.

Our analysis uses a different model and provides very different results. The aggregation of costs into activity-based product costs c_j does *not* require that the production (activity resource commitment) or the pricing problem be solved first. Rather, the aggregation only requires knowledge of production and cost *parameters*. More importantly, the pricing decision does not require any additional cost or production information beyond that contained in the aggregate activity-based product cost data. Furthermore, support activity capacities can be chosen based only on the demand, production, penalty and activity-based unit costs. This decision does not require detailed information about variable costs or normal support activity costs. In other words, the marginal value of variable cost and normal support activity cost information $\{v_j, m_i\}$, conditional on the availability of the activity-based cost information $\{c_j\}$, is zero with respect to both pricing and activity capacity decisions.

IV. Decentralized Information and Decisions

Reduction in Information Flows

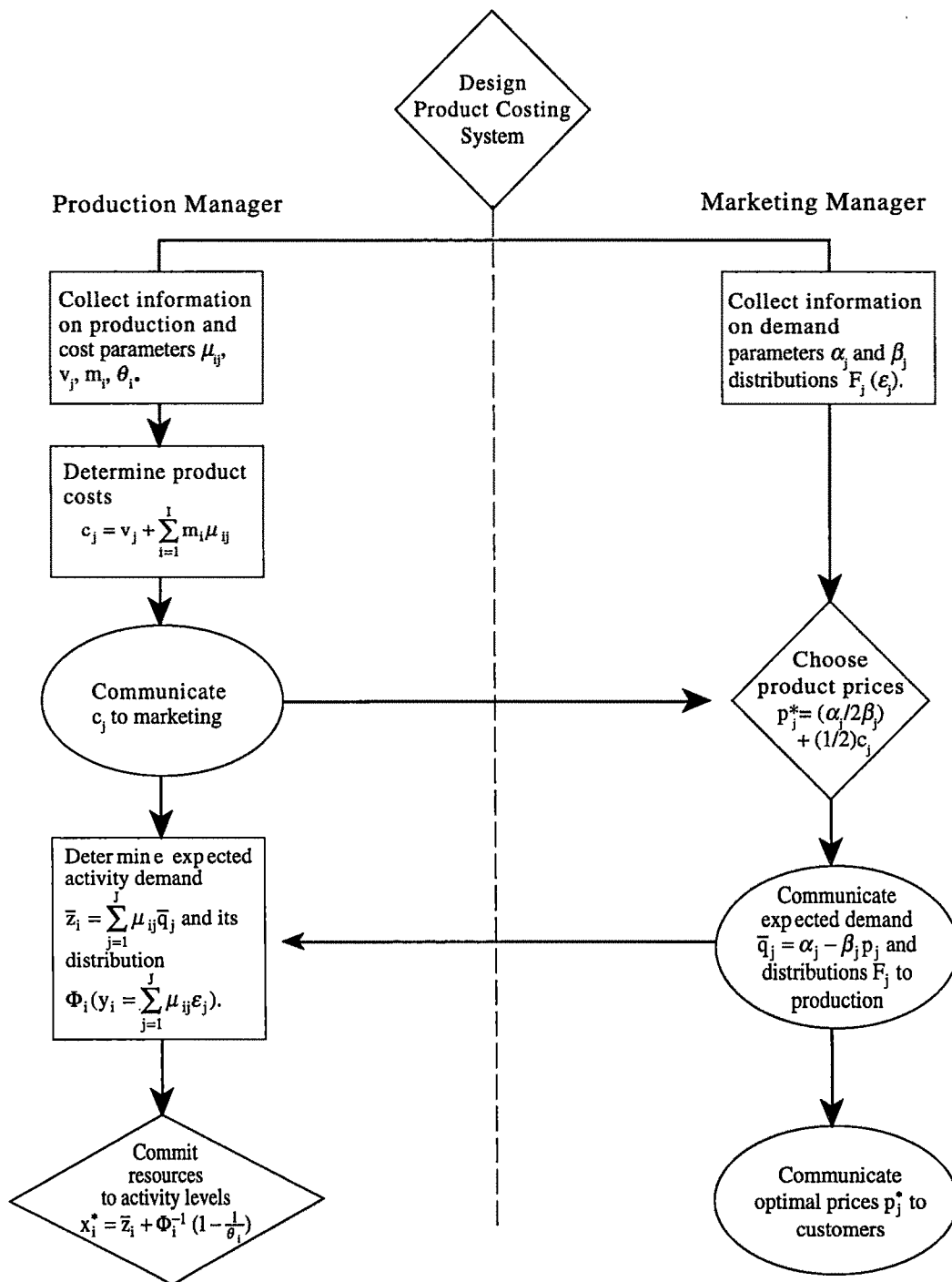
We have so far analyzed the pricing and activity capacity decisions only for a centralized organization. Now consider an organization with a production manager and a marketing manager, each receiving limited information and each responsible only for specified decisions as depicted in figure 2. We assume that two different managers are required for reasons, such as efficiencies that result from functional skill specialization, which are commonly presented in the literature on decentralization. A further assumption that follows naturally is that production and cost parameter information is available initially only to the production manager and demand information only to the marketing manager.

The product costing system is designed first, before the parameters characterizing the cost, production and demand functions are known. It specifies responsibility for information collection, aggregation and communication, and for product pricing and activity resource commitment decisions. Information aggregation and decision rules are specified up front, and are implemented based on the information collected subsequently by the product costing system.

The production manager learns the values of the production parameters μ_{ij} measuring the quantity of activity i required to support the production of a unit of product j , and the values of the cost parameters v_j , m_i and θ_i based on production engineering, purchasing, payroll and other pertinent records. Activity-based product costs c_j are determined using this information in accordance with the expression in (3).

This aggregated product cost information is communicated to the marketing manager, who augments it with information about demand parameters to determine the optimal price $p_j = (\alpha_j/2\beta_j)$

Figure 2
Decentralized Information Flows and Decisions



$+ (1/2)c_j$ for each product j . Having made the pricing decision and learning the distribution of demand, the marketing manager also determines the expected demand $\bar{q}_j = \alpha_j - \beta_j p_j$ and communicates information about both the expected demand and the demand distribution to the production manager. In our decentralized organization, the marketing manager has the best access to existing and potential customers, and therefore, is also responsible for communicating the product prices to them. Information on penalties, demand distribution, expected demand and production parameters enables the production manager to determine the optimal levels of capacities to commit to each activity in accordance with the expression in (7). The manager also takes the necessary actions to acquire the labor, tools, machinery and other resources required to provide these optimal activity capacities.

It is apparent from the above description of the decentralized information collection and decision making system that it results in the same (optimal) decisions as in the centralized organization we considered earlier. Yet, the decentralized arrangement requires considerably less information be communicated by or to the two managers responsible for making decisions than the totality of information collected by the organization. Assuming non-trivial costs for the transmission and assimilation of information, such an arrangement and the concomitant reduction of information flows is of value to the organization.

Of particular interest to us is the reduction in the information flows because of the aggregation of detailed cost information into activity-based product costs. Given the organizational separation of the availability of production, cost and demand information, some information must flow from one organizational unit to another for optimal decisions to be made. As we have seen earlier in (10), the optimal pricing decision requires $(IJ + J + I)$ dimensions for production and cost information $\{\mu_{ij}, v_j, m_i\}$, and $2J$ dimensions for demand information $\{\alpha_j, \beta_j\}$. By communicating aggregate activity-based product cost information $\{c_j\}$ that is economically sufficient for $\{\mu_{ij}, v_j, m_i\}$ with respect to pricing decisions, these information flows are reduced to only J dimensions. Although optimal capacity decisions require all demand, production and cost information, the only information required to be communicated to the production manager, who is already cognizant of the distribution of random demand shocks and cost and production parameters, is expected demand at the optimal prices. Thus, demand and price information is reduced to only the J dimensions of expected demand information $\{\bar{q}_j\}$ needed for the capacity commitment decision.

Nonetheless, while there are clearly savings in information flows implied by the economic sufficiency of $\{c_j\}$ for $\{\mu_{ij}, v_j, m_i\}$ in making pricing decisions, and of $\{\bar{q}_j\}$ for $\{\alpha_j, \beta_j, p_j\}$ in making initial capacity decisions, some transmission of information is necessary to implement optimal decisions. In other words, delegation of capacity decisions to the production manager and pricing decisions to the marketing manager does not imply that cost and production parameters are only germane to capacity decisions, and that demand parameters are only germane to pricing decisions. Thus, we have something less than complete decentralization. However, the dimensionality of information regarding those parameters can be reduced for transmission to the other unit without distorting those decisions.

Determination of Overhead Rates

Given the economic sufficiency result, we can now meaningfully address the question of determining overhead rates for the purpose of aggregating costs. Recommended accounting practice for product costing, per standard textbooks, calls for determining *budgeted* overhead rates, dividing budgeted activity costs by budgeted volume of the activity base. However, budgeted costs and volumes are generally not defined in precise terms. If the term *budgeted* is

interpreted as *expected*, then an overhead rate applicable to the i th activity could be calculated as shown below:

$$\begin{aligned}\hat{m}_i &= \left[m_i x_i^* + \theta_i m_i \int_{x_i^* - \bar{z}_i}^{\infty} (z_i - x_i^*) \phi_i(y_i) dy_i \right] / \bar{z}_i \\ &= m_i + \left[\theta_i m_i \int_{x_i^* - \bar{z}_i}^{\infty} y_i \phi_i(y_i) dy_i \right] / \bar{z}_i \\ &> m_i.\end{aligned}\quad (11)$$

Hence, we see that the budgeted overhead rate $\hat{m}_i$ is greater than m_i , implying that $\hat{m}_i$ is inappropriate for pricing purposes. This distortion occurs because the rate $\hat{m}_i$ reflects expected penalties for exceeding initial capacities for support activities, whereas optimal prices depend only on the normal costs m_i .¹⁸

An alternative definition of budgeted volume is the capacity of support activity that the firm initially makes available at the beginning of the budget period, a definition of budgeted volume consistent with *practical capacity*. If, in addition, expected penalties such as overtime premiums and delay costs are recorded separately in the accounting system, and not included together with the normal costs of activities, then the overhead rate is calculated simply as $m_i^* x / x_i^* = m_i$. Thus, a normative implication of our analysis is that the activity overhead rates employed for pricing should be calculated based solely on normal costs computed by dividing costs of committed resources by practical capacity. Expected penalties such as overtime premiums or delay costs should be excluded. Cooper and Kaplan (1992) also recommend dividing by practical capacity, but do not discuss the change needed in the numerator to eliminate expected penalties such as overtime premia. (See also Harvard Business School case 191-073 "Micro Devices Division.")

Generalized Demand

While we have employed a linear demand function for expositional convenience, our results on economic sufficiency extend to any general, well-behaved demand function. Observe that by using equation (7) for optimal capacities, we can rewrite the expected profits in (4) as:

$$E[\pi(\mathbf{x}^*, \mathbf{p})] = \sum_{j=1}^J (p_j - c_j) \bar{q}_j - \sum_{j=1}^J \theta_j m_j \int_{\Delta_j}^{\infty} y_j \phi_j(y_j) dy_j \quad (12)$$

where

$$\Delta_j = x_j^* - \bar{z}_j = \Phi_j^{-1} \left(1 - \frac{1}{\theta_j} \right).$$

Since the second term in the above expression is independent of product prices and quantities, it is transparent that the evaluation of expected profits requires only the separate consideration of each product's demand function and its activity-based cost. Given our assumption that $q_j > 0$ for all $j=1, \dots, J$, expected profits are maximized by prices that maximize expected gross profit for each product, where expected gross profit is computed as gross margin (revenues less activity-based costs) times the expected demand.

¹⁸ This source of distortion is distinct from that discussed in the activity-based costing literature. The distortion is caused by overstated overhead rates even when all cost drivers are recognized properly.

The correspondence between activity-based costs and optimal prices, therefore, extends to all well-behaved demand functions which are monotone decreasing in price. Analogous to (1), let

$$q_j = \bar{Q}_j(p_j) + \varepsilon_j, \quad j = 1, \dots, J, \quad (13)$$

with $p_j + \bar{Q}'_j(\bullet) < 0$. Writing $H_j(p_j) = p_j + \bar{Q}_j / \bar{Q}'_j$, it follows that optimal prices are given by

$$p_j^* = H_j^{-1}(c_j), \quad j = 1, \dots, J. \quad (14)$$

Although the prices in (14) no longer possess the same linear form, they continue to be a function of the same activity-based costs as before. In other words, activity-based costs are economically sufficient for detailed production and cost information, with respect to the product pricing decision, for any well-behaved downward-sloping demand function. They are also economically sufficient for $\{v_j, m_i\}$ with respect to the capacity decision as expected demand can be determined directly using (13) and (14). Thus, we could replace the linear demand and inverse demand functions contained in figure 2 with generalized functions with no qualitative change in our discussion.

V. Concluding Remarks

Starting with a centralized regime, we have characterized how support activity costs enter optimal pricing and initial capacity decisions in a setting related to the classic newsboy problem. Under conditions wherein capacity costs are committed *ex ante* and demand in excess of capacities is met by incurring penalties, our principal results are that (1) a firm facing uncertain demand at the time of those decisions will find normal activity-based unit costs economically sufficient in arriving at optimal prices; and (2) the firm can achieve the same results when it is decentralized along functional lines. The product costing system can be set in place without benefit of *a priori* demand, production and cost information; marketing managers need only learn activity-based unit costs in order to implement optimal pricing rules; and production managers need only learn expected demand, along with cost and production information, in order to make optimal commitments of resources to support activities. Notwithstanding the limitations of our assumptions—including divisible capacities, piecewise linear costs of resources, and absence of incentive problems which might arise under decentralization—the key role of normal activity unit costs in pricing decisions establishes further economic rationale for the emphasis given to activity-based cost systems.¹⁹

Among the possibilities for continued research along these lines, we note that the situation changes importantly when more can be learned about demand after initial capacities have been set and yet before prices need be determined. The activity-based unit cost aggregate, while appropriate as a benchmark, is no longer economically sufficient. Further demand information leads to an update of expected demand beyond the point in time when capacities of support activities can be expanded at normal costs. Explicit consideration must be given to the expected penalties required to ensure that demand is met. However, doing so is difficult except for certain distributions of demand.²⁰ Likewise, relaxing the restriction that no product is worth dropping, or that demand must be met, can also result in complexities which this paper does not consider. The difficulties posed by these generalizations call for research on the properties of cost-based

¹⁹ A recent survey of 566 controllers by the Institute of Management Accountants (Schiff 1991) indicated that 30 percent of the respondents had either already implemented an activity-based system or were considering it.

²⁰ Specifically, Banker et al. (1993) show that closed-form solutions to joint capacity and pricing decisions are feasible for the uniform distribution, but not in general.

heuristics such as the work of Hansen and Magee (1993). Although their model is formulated along different lines, it seems evident that development of such heuristics offers promise for a better understanding of the relationship between accounting measures of activity costs and pricing and capacity decisions. Empirical work in this area could examine plant- and firm-specific cost and production data to test the validity of the assumptions underlying product costing procedures. For example, if the evidence were to indicate significant violations of the Leontief characterizations of production, or other important elements of the structure we impose,²¹ then it may be necessary to modify present prescriptions as well as the model upon which they can be based. While much work remains to be done, this study and those cited provide the beginnings of a positive theory of product costing.

²¹ Any formal model is likely to be a stylized abstraction from reality, and ours is no exception. Accordingly, we would expect minor deviations between the data and the structure of our model such as those captured by noise terms in econometric specifications.

References

- Amershi, A., R. D. Banker, and S. M. Datar. 1989. Statistical sufficiency and economic sufficiency of accounting signals. *The Accounting Review* (January): 113-130.
- Banker, R. D., J. S. Hughes, and I. S. Khosla. 1993. Product costing and short-run pricing heuristics. Working paper, University of Minnesota, Minneapolis, MN.
- , S. M. Datar, and S. Kekre. 1988. Relevant costs, congestion and stochasticity in production environments. *Journal of Accounting & Economics* (Fall): 171-198.
- , G. Potter, and R. Schroeder. 1992. An empirical study of manufacturing overhead cost drivers. Working paper, University of Minnesota, Minneapolis, MN.
- Cooper, R., and R. S. Kaplan. 1987. How cost accounting systematically distorts product costs. In *Accounting and Management: A Field Study Perspective*, W. J. Bruns and R. S. Kaplan (Eds.), Harvard Business School Press.
- , and ———. 1992. Activity-based systems: Measuring the costs of resource usage. *Accounting Horizons* (September): 1-13.
- Demski, J. S., and G. A. Feltham. 1976. *Cost Determination: A Conceptual Approach*. Iowa State University Press.
- Dixit, A. 1979. A model of duopoly suggesting a theory of entry barriers. *The Bell Journal of Economics* (Spring): 20-32.
- Hansen, S. C., and R. P. Magee. 1993. Capacity cost and capacity allocation. *Contemporary Accounting Research* (Spring): 635-660.
- Kaplan, R. S. 1993. Research opportunities in management accounting. *Journal of Management Accounting Research* (Fall): 1-14.
- , and G. L. Thompson. 1971. Overhead allocation via mathematical programming models. *The Accounting Review* (April): 352-364.
- , and U. P. Welam. 1974. Overhead allocation with imperfect markets and nonlinear technology. *The Accounting Review* (July): 447-484.
- Miller, B. L., and A. G. Buckman. 1987. Cost allocation and opportunity cost. *Management Science* (May): 626-639.
- Miller, J. G., and T. E. Vollman. 1985. The hidden factory. *Harvard Business Review* (September-October): 142-150.
- National Association of Cost Accountants. 1953. *NACA Bulletin* (April).
- Schiff, J. B., ed. 1991. *Cost Management Update*. National Association of Accountants (January): 1-2.
- Walters, A. A. 1963. Production and cost functions: An econometric survey. *Econometrica* (January-April): 1-66.
- Whang, S. 1989. Cost allocation revisited: An optimality result. *Management Science* (October): 1264-1273.

The Relationship Between Financial Reporting Practices and the 1986 Alternative Minimum Tax

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SYNOPSIS AND INTRODUCTION: As examined in previous research (e.g., Gramlich 1991; Dhaliwal and Wang 1992), accounting accruals related to the alternative minimum tax (AMT) may either contain effects unrelated to the book income adjustment or be confounded by other changes in the 1986 Tax Reform Act. For example, total accruals in Gramlich (1991) arising from changes in accounts receivable and inventory have no effect on the book income adjustment because they affect taxable income and book income simultaneously.¹ Also, the repeal of the investment tax credit and a slower capital recovery schedule in the 1986 Tax Reform Act may induce firms to reduce investment. This change may decrease depreciation (a component of accruals in Gramlich (1991)) and the depreciation timing difference (a component of accruals in Dhaliwal and Wang (1992)) in 1987 and may contribute to the observed results.²

Prior research also relied on pre-1987 data and certain assumptions to predict the likelihood that firms would be subject to the AMT in 1987 (see Gramlich (1991) and Dhaliwal and Wang (1992) for examples). Such an approach is warranted only under an assumption of no change in tax status for the sample firms. However, the overwhelming changes instituted by the 1986 Tax Reform Act make such an assumption questionable. Misclassification of firms can lead to results attributable to sample partition rather than the AMT. Furthermore, firms with low tax payments are classified as the AMT firms in these studies. Since low tax payments may be an indication of poor financial condition, the AMT sample is likely to contain firms with

¹ Gramlich (1991) defined total accruals similar to that in Healy (1985) and DeAngelo (1986).

² For the AMT sample in this study, both the percentage of change in depreciation timing difference between 1986 and 1987 (part of accruals in Gramlich (1991)) and the difference in the ratio of depreciation timing difference to earnings (part of the accruals in Dhaliwal and Wang (1992)) between 1986 and 1987 are found to be negative and statistically significant at the five percent level (*t* statistics equal to -2.14 and -2.10 respectively).

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deteriorating financial condition which may lead to an overall decrease in accruals in 1987.

This study improved three aspects of previous research designs to test the effect of the book income adjustment on financial reporting. First, the sample consisted of firms that were indeed subject to the AMT in 1987 to ensure that only the behavior of AMT firms were examined. Second, only accrued expenses and revenues that were not sensitive to other major changes in the 1986 tax law were assessed. Third, a time-series model controlling for changes in firms' financial condition was used to estimate the unexpected accruals. In general, the results indicated that firms that were subject to the AMT in 1987 exhibited unusual shifts in accounting accruals in 1986 and 1987.

Unlike the institution of the AMT in 1987, the repeal of the book income adjustment in 1990 was independent of other major changes in tax law, providing a rather clean event to examine the effect of the book income adjustment on financial reporting. Evidence of accruals shifting for firms subject to the AMT in 1989 would lend further support to the conclusion that the AMT affects financial reporting practices. Accordingly, accruals of sample firms subject to the AMT in 1989 were examined. An unusual shift in accounting accruals was observed in 1989 but in a direction opposite to the 1987 sample.

Key Words: *Alternative minimum tax, Book income adjustment, Accounting accruals.*

Data Availability: *Data are available in public sources identified in the study.*

THE remainder of the paper consists of three sections. Section I discusses the measurement of accounting accruals that affect the book income adjustment, accounting disclosure of the alternative minimum tax, and the sample procedures. Section II presents the empirical results. Section III provides a summary and conclusion.

I. Research Design

Accounting Accruals

Results in Dhaliwal and Wang (1992) show that the AMT burden can be reduced by a decrease in the ratio of timing and permanent differences to book income, or a decrease in timing and permanent differences. Like any accounting numbers, timing and permanent differences can be altered by changes in financing and investment decisions, accounting methods, and accounting estimates. The first two alternatives may confound the effect of the book income adjustment for the following reasons. First, financing and investment decisions were also affected by other changes in the 1986 Tax Reform Act, e.g., changes in depreciation schedules. Second, the short life (1987–1989) of the book income adjustment and availability of AMT credit could make costly changes of accounting methods undesirable. These considerations make changes in accounting estimates the most likely place to observe the effects of the AMT on financial reporting.

As most permanent differences, such as tax-exempt interest, cannot be managed by changes in accounting procedures, changes in accounting estimates are more likely to be observed as changes in timing differences. As a result, this study concentrated on unusual changes in deferred tax arising from two major accounting accruals that are sensitive to accounting estimates. The first

was accrued expenses, where the accrual-basis taxpayer can deduct estimated expenses for financial accounting purposes but such deductions are deferred for tax purposes until the economic performance test can be met.³ For example, maintenance costs are accrued for financial reporting purposes but deductible for tax purposes only when maintenance is actually performed. The second was accrued revenues, which usually arise when revenues are recognized earlier for book purposes than for tax purposes. For example, unbilled revenues are accrued for financial reporting purposes when services are performed but may be taxable when payments for the services are collected.

Accrued expenses normally decrease timing difference and the book income adjustment; accrued revenues increase timing difference and the book income adjustment. To reduce the book income adjustment in 1987, firms may have wanted to increase accrued expenses and decrease accrued revenues in 1987. Similar effects could also be achieved by deferring accrued expenses and accelerating accrued revenues in 1986. As a result, if firms changed accounting estimates in 1986 and 1987 in response to the AMT, it is expected that timing differences related to accrued expenses and revenues will show an increase (a decrease) in 1986 (1987).

Table 1 presents two cases to show the effect of shifting accruals on the AMT for the same firm. In Case I, if the firm does not shift accruals, it reports \$1,200 of pre-tax book income, \$500 of taxable income, and AMT adjustments and preferences other than the book income adjustment of \$300 in 1987. The firm would be subject to \$50 of AMT if the regular marginal tax rate is 30%.

³ Economic performance is met only when the service, property or use of property giving rise to the liability is actually performed for, provided to, or used by the taxpayer.

Table 1
Cases Illustrating the Effect of Shifting Accruals on the AMT in 1987

	<i>Case I</i>	<i>Case II</i>
Taxable income	\$500	\$500
Add: Adjustments and preferences (other than the book income adjustment)	<u>300</u>	<u>300</u>
Alternative minimum taxable income before the book income adjustment	\$800	\$800
Add: Book income adjustment		
50% of (\$1,200 - \$800)	200	
50% of (\$840 - \$800)	<u> </u>	<u>20</u>
Alternative minimum taxable income	\$1,000	\$820
Minimum tax rate	<u>20%</u>	<u>20%</u>
Tentative minimum tax	\$200	\$164
Less: Regular income tax (30% of \$500)	<u>150</u>	<u>150</u>
Alternative minimum tax	<u>\$50</u>	<u>\$14</u>

Note. Case I represents the case before accruals shifting and Case II represents the case after accruals shifting. The firm is assumed to have \$200 of accrued expenses in 1986 and \$160 of accrued revenues in 1987 before accruals shifting. Pre-tax book income is \$1,200 in 1987 before accruals shifting. Pre-tax book income becomes \$840 after the firm deferred the accrued expenses to 1987 and accelerated the accrued revenues to 1986. Regular income tax rate is assumed to be 30%.

If the firm has \$200 of accrued expenses in 1986 and \$160 accrued revenues in 1987, by deferring the accrued expenses to 1987 and accelerating the accrued revenues to 1986, Case II shows that pre-tax book income is reduced to \$840 and the AMT also decreases by \$36 to \$14.

Alternatively, a similar effect could have been achieved by a change in taxable income. For example, accelerating economic performance on expenses to 1986 enabled firms to shift timing differences to 1986 while reducing the impact of the AMT in 1987. It also allowed expenses to produce a greater tax saving under a higher marginal tax rate in 1986. This tax incentive common to all firms was controlled by the use of a control group that did not pay AMT in 1987.

Accounting Series Release (ASR) No. 149 mandated that tax effects of any timing difference greater than five percent of the marginal statutory tax rate times pre-tax book income should be separately disclosed as a deferred tax item in the tax footnote to the financial statements. This disclosure allowed the identification of material accrued expenses and revenues (reserves or allowances) in the tax footnote to the financial statement.⁴

Timing differences arising from accrued expenses and revenues were measured by the sum of corresponding deferred tax items deflated by the statutory marginal tax rate. Changes in accounting estimates were measured by the first difference in the ratio of timing differences from accrued expenses and revenues to adjusted book income. That is,

$$\text{CHGACC}_t = (\text{TIMACC}_t / \text{BKIC}_t) - (\text{TIMACC}_{t-1} / \text{BKIC}_{t-1}), \quad (1)$$

where CHGACC_t is the change in accounting accruals in year t , TIMACC_t is timing differences from accrued expenses and revenues in year t , and BKIC_t is the adjusted book income which is measured by adding back to net book income total federal and foreign tax, discontinued operations, extraordinary items and the cumulative effect of changes in accounting method.

The first difference analysis assumed that the observed change in accounting accruals represented discretionary accruals. This approach, however, may contain the effects of accounting decisions made before the measurement period (Watts and Zimmerman 1990). Additionally, the use of first differences in measurement variables does not control for changes in economic conditions for individual firms (Schipper 1989).

One way to control for the non-discretionary component is to estimate the expected level of accounting accruals. The difference between the actual accruals and the expected accruals would then represent the discretionary component. (A similar approach can be found in McNichols and Wilson (1988), Jones (1991), and Cahan (1992).) To control for the non-discretionary accruals, the following model was estimated using data pooled across years (1983 - 88) and firms (AMT firms and control firms):

$$\text{TIMACC}_{it} / \text{BKIC}_{it} = \beta_0 + \beta_1 [\Delta \text{SALES}_{it} / \text{BKIC}_{it}] + \beta_2 D_{84} + \dots + \beta_6 D_{88} + \beta_7 T_{86} + \beta_8 T_{87} + \epsilon_{it}, \quad (2)$$

where TIMACC_{it} is timing differences from accrued expenses and revenues in year t , and BKIC_{it} is the adjusted book income in year t , ΔSALES_{it} is the change in sales between year $t-1$ and t , D_t is a year indicator variable with 1 for year t ($t = 1984, \dots, 1988$) and 0 otherwise, T_{86} is an indicator variable with 1 for AMT firms in 1986 and 0 otherwise, T_{87} is an indicator variable with 1 for AMT firms in 1987 and 0 otherwise, and ϵ_{it} is the disturbance term.

⁴ Accrued expenses and revenues in deferred tax are sometimes referred to as reserves or allowances in the disclosure. As a result, these terms are used interchangeably in this study.

Most accrued expenses and revenues are expected to vary with the change in sales, so ΔSALES_{it} was used to control for the change in economic conditions for individual firms (non-discretionary component). The indicator variable, D_i , allowed a control for the change in general economic conditions including the effect of changes in tax law. T_{86} and T_{87} were intended to estimate discretionary changes in timing differences by AMT firms in 1986 and 1987 respectively. If AMT firms deferred accrued expenses and/or accelerated accrued revenues in 1986 and accelerated accrued expenses and/or deferred accrued revenues in 1987, coefficients for T_{86} and T_{87} were expected to be positive and negative, respectively.

AMT and Accounting Disclosure

ASR No. 149 further required disclosure of a tax reconciliation process in the tax footnote to the financial statements. The process normally reconciled the difference between estimated tax expense based on the statutory tax rate and actual tax expense (a sum of current tax payable and deferred taxes).⁵ The reconciliation process in a non-AMT case can be summarized as follows:

$$t \text{ BKIC} + \text{PMTX} = \text{DFTX} + t \text{ TXIC}, \quad (3)$$

where t is the statutory marginal tax rate, BKIC is pre-tax book income, PMTX is the tax effect of permanent differences, TXIC is taxable income, and DFTX is deferred taxes. $t \text{ TXIC}$ is roughly equal to the current tax payable excluding the AMT.

The AMT increases the current tax payable and the right-hand side of the equation. The applicable accounting standards allow the reporting of the AMT in two ways to rebalance equation (3). The first approach is to report the additional tax under the AMT as a permanent difference item and increase PMTX in the left-hand side of the equation.

The second approach is to reduce the deferred tax credits by the AMT. Once paid, the AMT generates the AMT credit which can be used to offset future regular tax liability with no expiration date.⁶ APB Opinion No. 11 states that unused credits can be reported under the same rules applicable to net operating loss carryforwards. That is, the AMT credit can be used to eliminate the net deferred tax credits to the extent of the lower of (a) the tax effect of the credit carryforward, or (b) the amortization of the net deferred tax credits that would otherwise have occurred during the carryforward period. Under this approach, a deferred tax charge equal to the AMT will be created, and the increase in current tax payable by the AMT would be offset by a decrease in net deferred taxes equal to the AMT credit.⁷ Nevertheless, under either approach of disclosure, the AMT will be identifiable in the tax footnote to the financial statements if its amount exceeds five percent of the statutory marginal tax rate times pre-tax book income, according to ASR No. 149.

Sample

The following procedures were used to identify firms that were subject to the AMT: (1) The 1987 annual reports in the National Automated Accounting Research System (NAARS) database were searched for any sentence that contained the word "minimum" within two words of the word

⁵ Sometimes the reconciliation process begins with the statutory marginal tax rate and ends with a book effective tax rate (a ratio of actual tax expense to pre-tax book income).

⁶ The AMT credit, however, cannot reduce regular tax liability to an amount below the tentative minimum tax for the taxable year [Internal Revenue Code Sec. 53(c)].

⁷ Under this approach, the AMT would have no effect on total tax provision. For example, the disclosure in the footnote to the financial statements of Westinghouse Credit Corporation is as follows: "Consideration of the alternative minimum tax would have no impact on the total 1987 provision for income taxes but would increase taxes currently payable and reduce deferred taxes by \$16.9 million."

"tax." This procedure resulted in 474 firms. (2) Footnotes of the 474 firms were reviewed to identify firms that were indeed subject to the AMT, reducing the sample to 218 firms. (3) Firms in the utility industry and banking industry were excluded from the sample. Utility firms were eliminated because the rate-making process allows firms to recover tax paid and this may make utilities less sensitive to the AMT. Banks were excluded because results in Scholes et al. (1990) indicate that high regulatory and financial reporting costs make banks less inclined to minimize taxes. These industry exclusions reduced the sample to 153 firms. (4) Tax footnotes for the remaining firms were retrieved and examined to include only those firms reporting positive adjusted book income and deferred tax items relating to reserves or allowances. Firms with negative adjusted book income were excluded because the book income adjustment is less likely to cause the AMT.⁸ The final sample consisted of 56 firms that paid the AMT in 1987 and reported reserves or allowances in deferred tax.

II. Results

Descriptive Statistics

Table 2 provides an industry classification of the sample firms by two-digit SIC code. Twenty industries are represented and no industry is represented by more than seven firms. Five industries have five or more firms, but there does not appear to be a great concentration in any particular industry.

Table 3 contains descriptive statistics of the characteristics of the sample firms in 1987. The size distribution indicates that a wide range of firms is represented by the sample. Average AMT for the sample was \$2.55 million, and the largest payment of the AMT for the sample firms was \$18 million. On average, the AMT accounted for 55 percent of the total current federal income tax payment. A ratio of the AMT to current federal income tax equal to 100 percent indicated that all of the current federal income tax payment consisted of the AMT. Seventeen firms (30 percent of the sample) were in the situation of paying nothing but the AMT to the federal government in 1987. The ratio of the AMT to adjusted book income measured the average burden of the AMT. The effective tax rate for the AMT ranged from 1 percent to 76 percent with an average of 7 percent. That is, the AMT was roughly 7 percent of the sample firms' pre-tax book earnings.⁹

Analysis of Accounting Accruals

Deferred tax items arising from accrued expenses and accrued revenues were collected for the sample firms from the tax footnotes in the financial statements for the years 1983 to 1988.¹⁰ Table 4 shows a classification of these deferred tax items. Reserves and allowances in deferred tax were classified by the nature of the deferred tax items. The "general accrual" category contained deferred tax items related to reserves or allowances whose sources were not identifiable.

Table 5 contains results of the analysis of the changes in reserves and allowances for the AMT firms for the period from 1984 to 1988. No systematic changes in accounting accruals were

⁸ For example, a firm with \$150 of pre-tax book loss and a \$250 tax loss will have \$100 of book income adjustment. The book income adjustment will not cause AMT unless there are other preferences and adjustments.

⁹ Of the 56 sample firms, 26 (46.4%) are traded over-the-counter, 7 (12.5%) are listed in ASE, and 23 (41.1%) are in NYSE. The distribution of sample firms by stock exchange does not seem to differ from that in the NAARS database (chi-square (2) = 0.77, $p < 0.90$).

¹⁰ The earliest data available in NAARS are for 1983.

Table 2
Distribution of the AMT Firms by Industry

<i>2-digit SIC code</i>	<i>Industry</i>	<i>Frequency</i>
12	Coal mining	2
13	Oil and gas extraction	5
14	Nonmetallic minerals, except fuels	1
26	Paper and allied products	1
29	Petroleum and coal products	4
32	Stone, clay, and glass products	2
33	Primary metal industries	2
35	Industrial machinery and equipment	6
36	Electronic & other electric equipment	6
37	Transportation equipment	1
38	Instruments and related products	3
40	Railroad transportation	1
42	Trucking and warehousing	2
45	Transportation by air	5
47	Transportation services	2
50	Wholesale trade-durable goods	3
51	Wholesale trade-nondurable goods	1
56	Apparel and accessory stores	1
73	Business services	7
75	Auto repair, services, and parking	<u>1</u>
		<u>56</u>

Table 3
Descriptive Statistics for the AMT Firms

	<i>Median</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Minimum</i>	<i>Maximum</i>
Assets*	171.69	1486.50	3147.40	0.64	12580.00
Sales*	143.04	1374.80	3061.30	0.40	17170.00
AMT*	0.33	2.55	4.22	0.01	18.00
AMT/Current Federal Tax	0.45	0.55	0.38	0.05	1.00
AMT/Adjusted Book Income	0.45	0.07	0.11	0.01	0.76

* Amounts are in millions of dollars.

Table 4
Composition of Deferred Tax Items

<i>Nature of Deferred Tax</i>	<i>Number of Firms</i>	<i>% of sample Firms</i>
General accrual	38	68
Accrued expense	13	23
Accrued revenue	9	16
Asset write-off	11	20
Account receivable valuation	15	27
Insurance reserve	3	5
Inventory valuation	23	41
Vacation accrual	<u>5</u>	9
	<u>117</u>	

observed other than 1986 and 1987. A positive change in accounting accruals was observed in 1986 for the AMT firms. The statistically significant change in accruals for 1986 indicated that the sample firms experienced an increase in accounting accruals, suggesting that the firms subject to the AMT may have accelerated accrued revenues and deferred accrued expenses in 1986 to reduce the future book income adjustment. In contrast, the 1987 change in accruals for the AMT firms was negative and statistically significant at the 0.01 level. This result indicates that the AMT firms reported an unusual decrease in accounting accruals in 1987 to reduce the book income adjustment and the AMT.

As the 1986 Tax Reform Act also introduced changes other than the AMT, the above results may have been sensitive to these concurrent changes. To allow a control for these confounding factors, a control group was used. Firms in the control group were selected based on industry classification and size. For each AMT firm, all firms with the same three-digit SIC code were first identified in the 1987 annual reports of the NAARS database. These firms (including the AMT firm) were then ranked by total assets. A match firm is defined as the firm that has a ranking closest to the AMT firm and that also reported deferred tax items arising from accrued expenses and/or accrued revenues in 1987. Firms with assets ranking close to the AMT were searched until a firm that met the selection criteria was found.

A *t*-test comparing total assets between the AMT group and the control group (*t*-statistic = 0.061, *p*-value = 0.95) indicated that there was little size variation between the two groups, assuring that the control group was similar to the AMT group in size and industry membership. Changes in accounting accruals for the control group for years 1984 to 1988 were also computed and are reported in table 5. No particular pattern of changes in accounting accruals was observed for the control firms, which would indicate that firms not subject to the AMT did not exhibit any significant changes in accounting accrual behavior over the same period of time.

Tests comparing changes in accounting accruals between the AMT firms and the control firms are reported in table 6. The AMT firms showed a greater increase in accounting accruals in 1986, and a greater decrease in accounting accruals in 1987. These differences in 1986 and 1987 are statistically significant at least at the 0.10 level. No significant difference in accounting accruals between the two groups can be observed in other years. These results are consistent with

Table 5
Changes in Accounting Accruals for the AMT Firms and the Control Firms
from 1984 to 1988

	1984	1985	1986	1987	1988
<i>AMT Firms</i>					
Median	-0.006	0.025	0.129	-0.217	0.017
Mean	0.114	0.027	0.253	-0.432	0.040
Std. Dev.	0.68	0.56	0.89	0.95	0.79
<i>t</i> -stat.	1.24	0.34	2.05	-3.28	0.36
<i>p</i> -value	0.22	0.73	0.05	0.01	0.72
<i>Control Firms</i>					
Median	-0.035	-0.006	0.019	0.011	-0.016
Mean	-0.007	-0.088	-0.000	0.092	-0.032
Std. Dev.	0.64	0.80	0.55	0.53	0.54
<i>t</i> -stat.	-0.08	-0.79	0.00	1.26	-0.44
<i>p</i> -value	0.94	0.43	0.99	0.21	0.66

previous analyses of the AMT sample indicating that the AMT firms showed a greater increase (decrease) in accounting accruals in 1986 (1987).

A factor that is likely to contribute to previous results is the possibility of income smoothing by the AMT firms. If the AMT firms are more capital intensive, the 1986 Tax Reform Act (which allowed a slower capital recovery) was likely to make taxable income for the AMT firms higher in 1987 than in 1986.¹¹ That is, book income would also be higher in 1987, possibly inducing a firm to shift income from 1987 to 1986 for income-smoothing purposes. The income-smoothing hypothesis would confound the results if the AMT firms were more capital intensive or reported higher taxable income in 1987.

To examine the income-smoothing hypothesis, capital intensity (the ratio of total property, plant and equipment to total assets) was compared between the AMT firms and the control firms. A *t*-statistic of -0.94 (*p*-value = 0.35) indicated that there was no difference between the two groups. This similarity suggests that the effect of income smoothing arising from capital intensity would be common for both groups and that the use of the control group would be adequate to control for the effect. Furthermore, the percentage of increase in taxable income was computed to ascertain whether there was an unusual increase in taxable income in 1987. Taxable income

¹¹ The 1986 Tax Reform Act extended the useful life of most assets placed in service after 1986. This has the effect of reducing depreciation deduction and increasing taxable income.

Table 6
***t*-tests Comparing Changes in Accounting Accruals Between the AMT Firms**
and the Control Firms for Years 1984 to 1988

	1984	1985	1986	1987	1988
<i>t</i> -stat.	0.95	0.84	1.73	-3.51	0.55
<i>p</i> -value	0.35	0.40	0.08	0.00	0.58

was approximated by book earnings less deferred tax "grossed up" by the marginal tax rate. The average change in taxable income between 1987 and 1986 for the AMT firms is -14.1% (*t*-statistic = -0.86, *p*-value = 0.39). Both analyses suggest that income smoothing may not be a contributing factor to the observed results.

Table 7 presents results of equation (2). The overall model is statistically significant at less than the 0.01 level (*F*-statistic = 7.30).¹² Change in sales is negatively related to the level of accounting accruals. An increase in sales normally gives rise to greater accrued expenses and creates a greater deferred tax charge or lesser deferred tax. Coefficients for T_{86} and T_{87} are significantly positive and negative, respectively. That is, the AMT firms have deferred accrued expenses and accelerated revenues in 1986 and reversed that behavior in 1987. These results in general support those reported in the first-difference analysis.

Two sensitivity analyses were performed to verify the above results. First, to control for industry effect, equation (2) was expanded to include industry indicator variables based on the two-digit SIC code. The analysis indicated that the overall model was significant at less than the 0.01 level and that coefficients for T_{86} (*t*-statistic = 2.94) and T_{87} (*t*-statistic = -2.16) were both in the predicted direction. Second, by excluding variables T_{86} and T_{87} , equation (2) was estimated for the AMT firms and the control firms, respectively. The Chow test was then performed to ascertain whether the two models were the same.¹³ The *F*-statistic (7.88) of the test was statistically significant at the 0.01 level, which suggests that the models were different between the AMT firms and the control firms. Both sensitivity analyses yielded evidence supporting prior results.

Additional tests

A firm paying the AMT in 1987 only may have had less incentive to engage in income shifting if it could use the AMT credit in 1988 or 1989 to offset regular tax liability. In this case, the only saving for the firm in shifting income will be the time value of money associated with the AMT. Therefore, it is expected that firms paying the AMT in 1987 only were less likely to engage in income shifting in 1987 than firms paying the AMT every year from 1987 to 1989.

Sample firms' AMT status was verified for 1988 and 1989. Of the 56 sample firms, 23 firms were subject to the AMT in 1987 only and 5 firms were in an AMT position three years in a row from 1987 to 1989. The mean for changes in accounting accruals in 1987 is -0.257 for the group with the AMT in 1987 only and -0.714 the group with the AMT every year from 1987 to 1989.

¹² The residuals of the regression were also analyzed to verify whether they are normally distributed and whether they are independent. A plot of the residuals and a test of the skewness of residuals indicate that the distribution of residuals is not different from normal. The Durbin-Watson test of the residuals also suggests that the residuals are not dependent.

¹³ The Chow test based on the *F* test is used to verify whether coefficients of two regression equations are equal (Chow 1960).

Table 7
Changes in Accounting Accruals in 1986 and 1987 Estimated by Equation (2)
(t-statistic in Parentheses)

$$\text{Model: TIMACC}_{it}/\text{BKIC}_{it} = \beta_0 + \beta_1[\Delta\text{SALES}_{it}/\text{BKIC}_{it}] \\ + \beta_2D_{84} + \dots + \beta_6D_{88} + \beta_7T_{86} + \beta_8T_{87} + \varepsilon_{it}$$

	<i>Coefficients</i>	<i>Adj. R²</i>	<i>F</i>
		0.12	7.30*
Intercept	-0.067 (-1.05)		
$\Delta\text{SALES}_{it}/\text{BKIC}_{it}$	-0.008 (-5.85)*		
T_{86}	0.367 (3.02)*		
T_{87}	-0.223 (-2.01)*		

Note: TIMACC_{it} is timing differences arising from accrued expenses and revenues in year t , and BKIC_{it} is the adjusted book income in year t , ΔSALES_{it} is the change in sales between year $t-1$ and t , D_t is a year indicator variable with 1 for year t ($t = 1984, 1988$) and 0 otherwise, T_{86} is an indicator variable with 1 for the AMT firms in 1986 and 0 otherwise, T_{87} is an indicator variable with 1 for the AMT firms in 1987 and 0 otherwise, and ε_{it} is the disturbance term. The regression has degrees of freedom of 495.

* Statistically significant at the 0.05 level.

The t -statistic comparing the changes in accounting accruals between these two groups is statistically significant at the 0.10 level based on the one-tail test. Firms with a possibility of utilizing the AMT credit in the short run were less likely to engage in income shifting than firms subject to AMT on a continuing basis.

Furthermore, the book income adjustment was replaced by an adjustment based on the adjusted current earnings (ACE) in 1990. Specifically, a firm has to include 75 percent of the excess of the adjusted current earnings over the alternative minimum taxable income (before considering the ACE adjustment). Unlike the book income adjustment, the ACE adjustment is not based on income reported for book purposes. Therefore, firms subject to the AMT after 1989 would have no further incentives to shift accruals. Nevertheless, firms that were subject to the AMT in 1989 may find it tax efficient to minimize the book income adjustment by shifting accruals from 1989 to 1990 without the AMT consequences under the book income adjustment in the future.

To examine this hypothesis, 15 firms were identified to have paid the AMT in 1989 in the current sample. Accruals data were collected for these firms in 1989 and 1990. The mean difference in accruals (scaled by earnings) between 1990 and 1989 is 0.074, which is statistically significantly different from 0 at the five percent level (t -statistic = 2.01) based on one-tail test. This indicates that firms in an AMT position in 1989 had less income-increasing accruals in

1989 than in 1990. The result that the 1989 AMT firms shifted accruals to a later year is consistent with evidence observed for the 1987 sample.

III. Conclusion

This study employed a modified research design to examine the effect of the book income adjustment in the 1986 AMT on financial accounting practices. The analysis first identified accrued expenses and revenues in deferred tax as a measure of the effect of the book income adjustment on accounting practices. Accounting disclosures of the AMT in the NAARS database were used to identify sample firms that were subject to the AMT in 1987. Deferred tax items arising from accrued expenses and revenues were analyzed for the AMT firms. Additionally, a control group was employed to control for potential confounding factors caused by the 1986 Tax Reform Act.

The analyses in general indicate that the AMT firms changed accounting practices in response to the book income adjustment. The AMT firms were observed to have deferred accrued expenses and accelerated accrued revenues in 1986. In contrast, accrued expenses were accelerated and accrued revenues were deferred in 1987 for the AMT firms. The AMT firms also exhibited a greater increase (decrease) in accounting accruals in 1986 (1987) than the control firms. Accrual shifting was also observed for the firms that were in an AMT situation in 1989, but in a direction opposite to the 1987 sample. These results provide consistent evidence concerning the effect of the AMT on financial reporting for both the institution of the book income adjustment in 1987 and the repeal of the provision in 1990.

References

- Cahan, S. 1992. The effect of antitrust investigation on discretionary accrual: A refined test of the political-cost hypothesis. *The Accounting Review* 67 (January): 77-95.
- Chow, G. C. 1960. Tests of equality between subsets of coefficients in two linear regressions. *Econometrica* 28: 591-605.
- DeAngelo, L. E. 1986. Accounting numbers as market valuation substitutes: A study of management buyouts of public shareholders. *The Accounting Review* 61 (July): 400-420.
- Dhaliwal, D., and S. Wang. 1992. The effect of book income adjustment in the 1986 alternative minimum tax on corporate financial reporting. *Journal of Accounting and Economics* 15 (March): 7-26.
- Gramlich, J. 1991. The effect of the alternative minimum tax book income adjustment on accrual decisions. *Journal of American Taxation Association* 13 (Spring): 36-56.
- Healy, P. 1985. The effect of bonus schemes on accounting decisions. *Journal of Accounting and Economics* 7 (April): 85-107.
- Jones, J. 1991. Earnings management during import relief investigations. *Journal of Accounting Research* 29 (Autumn): 193-228.
- McNichols, M., and G. Wilson. 1988. Evidence of earnings management from the provision for bad debts. *Journal of Accounting Research* 26 (Supplement): 1-31.
- Schipper, K. 1989. Commentary on earnings management. *Accounting Horizons* 3 (December): 91-102.
- Scholes, M., G. Wilson, and M. Wolfson. 1990. Tax planning, regulatory capital planning, and financial reporting strategy for commercial banks. *Review of Financial Studies* 3: 625-650.
- Watts, R., and J. Zimmerman. 1990. Positive accounting theory: A ten year perspective. *The Accounting Review* 65 (January): 131-156.

BOOK REVIEWS

James R. Boatsman, Editor

Editor's Note: Two copies of books for review should be sent to Dr. James Boatsman, School of Accountancy, Arizona State University, Tempe, AZ 85287-3606. The policy of the *Review* is to publish only those reviews solicited by the Book Review Editor. Unsolicited reviews will not be accepted.

JOHN BLAKE and ORIOL AMAT, *European Accounting* (London: Pitman Publishing, 1993, pp. ix, 224).

European Accounting describes financial accounting and reporting in each of the 12 member countries of the European Community (now European Union) and Sweden. It also has an overview of socialist accounting in Eastern Europe. It is a useful reference for faculty, students, and accounting practitioners wanting succinct, introductory level, descriptions of accounting in these countries. A short course focusing on accounting in Europe can also be built around this book.

The book contains 18 chapters. The first three provide background on comparative international accounting. Chapter 1 explains why accounting differences exist, the pressures to reduce them, and classifications of accounting systems. Chapter 2 is about accounting regulation, discussing public and private sector bodies at the national and international levels. The International Accounting Standards Committee (IASC) and the European Community (EC) are introduced here, and the chapter discusses the audit of multinational enterprises, and international auditing firms. Chapter 3 considers around a dozen specific accounting issues where national practices vary around the world. Relevant EC directives and IASC standards are considered at the same time. Unfortunately, the IASC coverage is dated since it does not consider the recent comparability and improvements project, initiated in 1989 with Exposure Draft 32. (These same dozen issues are discussed in each of the next 13 chapters on accounting in the EC countries and Sweden.) In general, these three chapters tread no new ground and will be completely familiar to specialists in international accounting. However, they still make interesting reading, since the authors have their own perspectives on the topics, and they offer some original examples and illustrations. At the same time, these chapters will inform the uninitiated.

The heart of the book is the next 13 chapters (4 through 16), covering accounting in the EC member countries and Sweden. They average about 10 pages in length. Background is first provided on the country's accounting regulations, professional accounting structure, auditing requirements, accounting conventions, and presentation of financial statements. Next are discussions of specific practice issues such as accounting for consolidations, goodwill, fixed assets, inventory, leases, pensions, and post balance sheet events. Both measurement and disclosure issues are covered, as are the country's requirements and predominant practices. However, three issues are not covered which I think should be: the use of discretionary reserves to smooth income, social and nonfinancial reporting, and segmental reporting. The first two are especially important in a European context, while the last one is growing in concern around the world.

Chapter 17 provides an overview of socialist accounting in Eastern Europe. This is mostly background and description before the recent political and economic liberalization in these countries, and would have been more interesting had the authors brought us up to date. The book ends with Chapter 18 on international financial statement analysis. Here, the authors highlight the difficulties in conducting such an analysis, but never reveal how to actually do one. As with the first three chapters in the book, these two will be familiar to someone already knowledgeable in international accounting.

Overall, the book is well written, and it is easy to read and understand. Notwithstanding the few criticisms noted above, I recommend it for anyone wanting succinct descriptions of the essential features of accounting in these 13 countries, without getting bogged down in a lot of details. Additional references are provided for those wanting to probe further. Besides accounting practitioners, academics teaching international accounting courses will find it a handy reference source. Their students—including undergraduates—

will also find it useful, such as for term papers. In addition, anyone unfamiliar with international financial accounting will be informed by the first three and the last two chapters. In my opinion, the scope of the book (European financial accounting) is too narrow to be used as a textbook for an entire course in international accounting. However, it would have a place in a shorter module focusing on this important part of the accounting world.

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K. E. DAKDDUK and JULES M. CASSEL, *Special Report—A Guide to Implementation of Statement 106 on Employers' Accounting for Postretirement Benefits Other Than Pensions—Questions and Answers* (Norwalk, CT: Financial Accounting Standards Board, 1993, pp. iii, 55).

This book is the latest addition to the series of implementation guides issued by senior staff at the Financial Accounting Standards Board (FASB). This book addresses questions encountered in implementing 106 that are unique to postretirement benefits other than pensions (OPEBs). For implementation issues similar to those encountered with pensions, the authors refer readers to implementation guides for FASB Statement 87, Employers' Accounting for Pensions and Statement 88, Employers' Accounting for Settlements and Curtailments of Defined Benefit Pension Plans and for Termination Benefits. Although the book is probably of most interest to practitioners, it should also be valuable to many professors.

The question and answer format of the book is identical to other books in this series. The topical index and cross-referencing between questions and Statement 106 paragraphs make it relatively easy to ascertain whether desired information is contained in the guide. The 64 questions address a wide variety of topics, ranging from method of transition to handling of OPEBs in business combinations. Where necessary, the authors provide numerical examples to illustrate the proper accounting or calculation method.

Approximately 25 percent of the text concerns reductions in OPEB obligations caused by negative plan amendments and/or curtailments. The authors make a distinction between these events because gains associated with negative plan amendments are recognized in income over time while gains associated with curtailments are recognized immediately. The authors explain that a negative plan amendment reduces benefits for service already rendered but does not reduce expected years of future service or prevent the earning of benefits for future services. In contrast, a curtailment significantly reduces expected years of future service or eliminates benefits associated with future service. A curtailment can occur because of a plant closing or upon the suspension or termination of a plan. The authors' explanations and examples in this area clarify greatly discussions and examples provided in Statement 106.

The discussion on curtailments and negative plan amendments may be of special interest to professors teaching financial statement analysis courses or conducting research which directly or indirectly involves OPEBs. The authors' explanations should help the professor reconstruct accounting entries made by a firm at the time that retiree benefits are reduced and provide some insight into how to adjust for the event in time-series or cross-sectional analyses. Other questions addressed in the guide also may arise as the professor or students analyze financial statements.

Although professors teaching intermediate accounting classes normally would not address many of the complex issues covered in the guide, it still may be used by the professor to answer questions asked by students or by students in conducting research on an accounting case. For example, a complex accounting case, such as a Trueblood Case, could require a student to examine this implementation guide. Because the FASB implementation guides are contained on the Financial Accounting Research System (FARS), students with access to FARS will be able to retrieve the guide in the same way that they retrieve FASB Statements.

This book is an integral supplement to Statement 106. Professors who refer to Statement 106 on a regular basis should also have this book in their reference library.

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ERIC L. DENNA, J. OWEN CHERRINGTON, DAVID P. ANDROS, and ANITA SAWYER HOLLANDER, *Event-Driven Business Solutions: Today's Revolution in Business and Information Technology* (Homewood, IL: Business One Irwin, 1993, pp. ix, 168, \$40.00).

This book provides an overview of a new approach to building and maintaining information systems and raises a number of provocative questions about the future of accounting and auditing. The authors argue that existing information systems are too narrowly focused and are not effectively integrated with one another. Consequently, traditional information systems do not adequately meet the information needs of the organizations as a whole, and top management in particular. The solution, according to the authors, is to adopt the event-driven approach to designing systems. Systems designed using that methodology store all data in one central data repository (database) that can be accessed by all authorized users.

Chapters 3 and 5 use the operations of a mail order business to illustrate the event-driven methodology. Business events are defined as "the essential organization activities that management wants to plan, control, and evaluate" (p. 57). Thus, some events for the mail order business are customers placing orders, the shipment of merchandise, and the receipt of payment for that merchandise. The REAL method is used to model the organization's data needs. The acronym REAL stands for the four basic types of entities that must be modeled: the Resources used, the Events involving those resources, the Agents (e.g., employees, customers, suppliers) who participate in those events, and the Locations where the events occur. Chapter 5 provides a comprehensive example of using REAL modeling and other tools in order to design an event-driven system for the mail order business.

Throughout the remainder of the book, the authors seek "to change the way people think about business processes, organization structures, the use of technology and business measurements, and to consider the potential role of what we call business solution professionals" (p. vi). Chapter 1 grabs the reader's attention by presenting the two examples (IBM and the State of Oregon's Department of Transportation) that illustrate the significant cost savings and improved effectiveness possible with the event-driven approach. In both cases, the redesign of the accounting system resulted in dramatic (over 60 percent) reductions in accounting staff. The authors then argue that "the skill sets of accounting and IT [Information Technology] professionals can, must, and are merging to create a new information professional" (p. 16).

In Chapter 4, the authors address the topics of internal controls and auditing. They argue that auditors need to shift from the concept of tolerable error to the goal of error elimination (akin to the goal of zero defect manufacturing). The authors suggest that one way to achieve this might be to require auditors to be more deeply involved in systems design. The authors also argue that the lack of traditional segregation of duties in the new systems should not be a cause for concern because the role played by the computer in such systems can provide much more control over processing than was ever possible in manual systems. They then discuss the role played by electronic mail messages in settling Borland and Symantec's 1992 dispute about trade secret violations to illustrate the advantages of an electronic audit trail over traditional paper-based one.

This well written book should be read by all professors and practitioners who are interested in how advances in informational technology are likely to affect the future of accounting. Moreover, although it is not a textbook, those who teach accounting information systems courses may find the material in Chapters 3 and 5 to be a useful supplement to textbook coverage of data modeling.

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R. K. McCABE, *The Accountant's Guide to Peer and Quality Review* (Westport, CT: Quorum Books, 1993, pp. xix, 226, \$58.50).

This book provides useful guidance to firms undergoing their initial Private Companies Practice Section (PCPS) peer review or quality review under the AICPA's quality review program and to reviewers who intend to conduct such practice monitoring reviews. It also would be informative to academicians who have little or no knowledge of the history of these programs to self-regulate firms, of what a peer or quality review is all about, and of the AICPA's standards of quality control. The author knows the programs well from both a theoretical and practical point of view, believes that they have upgraded and will continue to

upgrade the quality of professional practice of the firms who undergo review, recognizes that the programs have limitations, and offers some suggestions in the final chapter to the AICPA leadership and others to improve them and professional practice in general.

Just as the National Commission on Fraudulent Financial Reporting (the Treadway Commission) found the "tone at the top" to be critical to the integrity of the financial reporting process, the author notes: "The tone set by CPA firm management is the most important influence on the quality control system's integrity" (p. 70). In fact, he believes that the most important suggestion in the book is: "The scope of peer and quality review must be expanded to assess the firm's tone at the top" (p. 193).

Firms undergoing their initial review should benefit from the practical discussion of the "nine interrelated functional areas" in chapter 5 and the appendix, "Quality Control Policies with Guidelines to Establish Procedures." For example, the author points out what may seem, but apparently is not, obvious, namely—if a firm's acceptance policy permits taking on high-risk clients, then its quality control policies for assigning personnel, supervision and professional development need to be particularly strong.

Of particular value to firms new to peer or quality review is the discussion of "Problems to Avoid" in chapter 8. The author has compiled a listing of the deficiencies that peer and quality reviews frequently surface. Firms undergoing initial review would be well advised to review this listing with all accounting and auditing personnel and provide training, as necessary, to personnel just prior to conducting the audit and accounting engagements which will be subjected to peer or quality review to avoid the problems cited by the author, such as failure to adequately document audit planning considerations and common disclosure problems.

Reviewed firms and new reviewers alike should find helpful the description of the entire review process contained in chapter 7, including the subjective considerations that team captains must weigh in deciding the type of report to issue and the deficiencies that should be reported in the letter of comment. However, the author's statement on page 149 that material design deficiencies often lead to modified or adverse reports probably should be somewhat modified to reflect actual experience. Such modified reports are not likely to be issued, if the design deficiencies are not accompanied by incidents of failure to comply with professional standards on engagements. The author makes the important point that poor documentation of audit, review or compilation procedures should "make the reviewer question whether the firm emphasizes growth and profitability at the expense of quality" and "... look a little harder and, as a result, issue a modified report" (p. 131).

Chapter 9 includes 25 recommendations by the author to improve peer and quality review and professional practice in general. It is interesting to note that several of these are currently receiving very serious attention within the SEC Practice Section and the AICPA, for example—strengthening the CPE requirement, enhancing the auditor's ability to detect management fraud, improving the documentation of audit, review and compilation performance, and merging the Private Companies Practice Section peer review program with the quality review program.

It should be noted that the author has not attempted to deal in depth with the peer review and other activities of the SEC Practice Section (SECPS) of the Division for Firms despite the fact that he recommends extending the activities of the Section's Quality Control Inquiry Committee and the oversight activities of its Public Oversight Board to all firms. Consequently, the reader must look elsewhere for information about the differences between the SECPS peer review standards and those discussed in the book, for example, "the risk-based approach" to determining the scope of an SECPS peer review and the unique quality control requirements imposed on SECPS member firms, such as concurring partner review, rotation of a partner on an engagement after several years, and the requirement to document the "supervision and control" of audit work performed by other firms on a segment of a client.

Despite the limitation cited in the preceding paragraph, the author has provided a highly useful discussion of the program to PCPS and quality review program firms undergoing initial review and their reviewers as well as to academicians who have not been exposed to these important components of the profession's self-regulatory program. He is to be commended for his thoughtful recommendations to the leaders of the profession and regulators to improve the programs and professional practice.

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HOWARD M. SCHILIT, *Financial Shenanigans: How to Detect Accounting Gimmicks & Fraud in Financial Reports* (New York: McGraw-Hill, Inc. 1993, pp. xv, 191, \$22.95).

This book is intended as a "how-to" guide to help financial statement users detect accounting tricks or "shenanigans." It defines financial shenanigans broadly as "actions or omissions intended to hide or distort the real financial performance or financial condition of an entity" (p. 1). Thus the shenanigans discussed span the range from minor deceptions accomplished within the discretion allowed by GAAP to major frauds.

The author studied (using public sources of information only) a number of cases where companies filed false and misleading financial statements and identified seven major shenanigans: (1) recording revenue before it is earned, (2) creating fictitious income, (3) boosting profits with nonrecurring transactions, (4) shifting current expenses to a later period, (5) failing to record or disclose liabilities, (6) shifting current income to a later period, and (7) shifting future expenses to an earlier period.

Despite the breadth of the definition of shenanigans, this list of seven shenanigans is not all inclusive. Neither are the discussions of them. For example, the income decreasing shenanigans (numbers 6 and 7) are discussed only as methods of building up cushions against future downturns. They might usefully have been discussed also as a method of temporarily depressing entity value, for example, just prior to a management buyout. And the book does not discuss all balance sheet "windowdressing" shenanigans, which are common in financial institutions. But the list does represent seven major types of shenanigans that enable managers to manipulate net income.

The core of the book devotes one chapter to a discussion of each shenanigan type. The chapters describe variations of the type of shenanigan, real company examples of each, and methods of detecting them. Other chapters in the book describe why shenanigans exist, how to search for them, why the cash flow statement is important in the search for shenanigans, how inventory, sales and receivables must "balance," how society can prevent shenanigans, and how some prominent 20th century shenanigans took place.

My main criticism of the book is that the author overstates its value. He claims, among other things, that by reading the book "investors will learn to identify overvalued companies and will consequently pick winning stocks more often [and] bankers and other lenders will learn to spot companies with weak cash flows and unrecorded liabilities, enabling them to lend money more judiciously to such risk entities" (p. xii). This book will provide few of these benefits. I think it is best suited for a relatively unsophisticated audience.

I will describe three elements of the content of the book to illustrate how basic its treatment of the subject is. First, readers are reminded in each shenanigan chapter of a "guiding [accounting] principle." In Chapter Three, on Shenanigan No. 1: Recording Revenue Too Soon, the principle is: "Revenue should be recorded after the earnings process has been completed and an exchange has occurred" (p. 34). These principles will not enlighten any reasonably sophisticated financial statement analyst, or even advanced accounting or finance students.

Second, the main points of the book are summarized in checklists, such as 11 "signs of misleading financial statements" (p. 151) and 52 "techniques for finding shenanigans" (pp. 152-153). But these suggestions are quite basic, even when discussed at some length in the chapters. For example, among the 52 techniques are "Be alert for misguided management incentives"; "Watch for qualified opinions"; and "Be wary of worthless investments."

Third, the book includes a basic accounting and financial statement tutorial which is intended for readers who have never taken an accounting course or for those who have taken a course or two "yet remember nothing" (p. 167). It purports to teach these readers "all the formal accounting [they will] need to know to understand financial statements" (p. 167). But since this discussion is provided in *less than six pages*, it is obvious it will not provide much sophistication.

A few other criticisms are also possible. Some of the suggestions are difficult for financial statement users to implement. For example, in the chapter on the "Recording Revenue Too Soon" shenanigans are suggestions to "check whether the buyer has financing to pay" (pp. 41-43) and to "determine whether the customer is obligated to pay" (pp. 43-44). In most cases, financial statement users do not have access to information about the terms of sale and customer's abilities to pay. They might not even know who the company's customers are. The author might usefully have distinguished between shenanigans that sophisticated analysts can find and analyze and those which are indiscernible because cues to locate them are not publicly disclosed.

Some of the suggestions in the book are so general that they are meaningless. For example, in Chapter Twelve, which provides suggestions for preventing shenanigans, the author's four suggestions are (1)

improve auditors' abilities to audit, (2) improve training for financial statement users, (3) improve the control environment within organizations, and (4) restructure managers' incentives. Little elaboration is provided. In this chapter he goes on to paraphrase the conclusions of the Treadway Commission, but there are no new insights here.

Some of the examples discussed are quite old. They include discussions of Stirling Homes (1972), W. T. Grant (1975), Chrysler (1980), Lockheed (1981), Manville Corporation (1982). This is not a serious problem because many shenanigans are timeless, but the plethora of recent shenanigans should have negated the need to use such old examples.

And finally, the author cites almost none of the now considerable and growing academic research related to earnings management. His book shows little awareness of the insights that have been gained—about the incidence, economic effects, and ethics of various financial shenanigans. Incorporating the academic findings into the book would have helped inform the intended readers.

While I do not think this book has achieved its lofty claims, I do think it could be useful as a supplementary text in a beginning course on financial statement analysis. The style of writing and the numerous examples make the book easy and fun to read.

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BOOKS RECEIVED NOVEMBER 1, 1993 TO FEBRUARY 15, 1994

KRISTINA ARTSBERG, ANNE LOFT, and STEFAN YARD, eds., *Accounting Research in Lund* (Lund, Sweden: Lund University Press, pp. 248).

JOHN BLAKE, *Accounting Standards* (London: Pitman Publishing, 1994, pp. ix, 260).

JOHN BLAKE and ORIOL AMAT, *European Accounting* (London: Pitman Publishing, 1993, pp. viii, 244).

LAWRENCE D. BROWN, JOHN C. GARDNER, and MIKLOS A. VASARHELYI, *Accounting Research Directory*, 3rd ed. (Princeton, NJ: Markus Wiener Publishers, 1994, pp. x, 694, \$69.95).

RAYMOND BROCKINGTON, *Dictionary of Accounting and Finance* (London: Pitman Publishing, 1993, pp. 240).

THE CHARTERED INSTITUTE OF MANAGEMENT ACCOUNTANTS, *Performance Measurement in the Manufacturing Sector* (London: The Chartered Institute of Management Accountants, 1993, pp. 58, £2).

THE CANADIAN INSTITUTE OF CHARTERED ACCOUNTANTS, *Using Ratios and Graphics in Financial Reporting* (Toronto: Canadian Institute of Chartered Accountants, 1993, pp. 238, \$35.00).

DOUGLAS R. CARMICHAEL and MARTIN BENIS, *Auditing Standards and Procedures Manual 1994* (New York: John Wiley & Sons, Inc., 1994, pp. xii, 750, \$115.00).

COOPERS & LYBRAND, *International Accounting Summaries* (New York: John Wiley & Sons, Inc., 1993, \$105.00).

KENNETH A. BRUFFEE, *Collaborative Learning* (Baltimore: The Johns Hopkins University Press, 1993, pp. xiii, 240, \$20.95).

JOSEPH W. DUNCAN and ANDREW C. GROSS, *Statistics For the 21st Century* (New York: The Dun & Bradstreet Corporation, 1993, pp. vi, 266, \$14.95).

- ALAN GART, *Regulation, Deregulation, Reregulation: The Future of the Banking, Insurance, and Securities Industries* (New York: John Wiley & Sons, Inc., 1994, pp. ix, 422, \$49.95).
- W. M. HARPER, *Cost Accounting* (London: Pitman Publishing, 1993, pp. vii, 483, 11.99).
- DAVID HATHERLY, *Accounting for Business Activity* (London: Pitman Publishing, 1993, pp. xi, 305).
- INTERNATIONAL ACCOUNTING STANDARDS COMMITTEE, *Proposed International Accounting Standard: Financial Instruments* (London: International Accounting Standards Committee, 1994, pp. 127).
- POUL ISRAELSEN, *Activity-Versus Variability-Based Management Accounting* (Copenhagen: DJOF Publishing, 1993, pp. 160, DKK 225,000).
- JOSEPH S. JOHNSTON, JR. and RICHARD J. EDELSTEIN, *Beyond Borders: Profiles in International Education* (Washington: Association of American Colleges, 1993, pp. 78, \$20.00).
- PETER H. KNUTSON, *Financial Reporting in the 1990s and Beyond* (Charlottesville, VA: Association for Investment Management and Research, 1993, pp. viii, 97).
- DAVID H. MAISTER, *Managing the Professional Service Firm* (New York: The Free Press, 1993, pp. xvi, 376, \$39.95).
- WOLODYMYR MOTYKA, *Annotated Bibliography of Russian Language Publications on Accounting 1736-1917* (New York: Garland Publishing, Inc., 1993, pp. 389).
- GEORGE J. MURPHY, ed., *A History of Canadian Accounting Thought and Practice* (New York: Garland Publishing, Inc., 1993, pp. xi, 652, \$133.00).
- KURT PANY and O. RAY WHITTINGTON, *Auditing* (Burr Ridge, IL: Richard D. Irwin, Inc., 1994, pp. xxiii, 728, \$61.95).
- HARRY R. REIDER, *The Complete Guide to Operational Auditing* (New York: John Wiley & Sons, Inc., 1994, pp. xix, 282, \$95.00).
- PATRICK L. ROMANO, ed., *Activity-Based Management in Action* (Montvale, NJ: Institute of Management Accountants, 1994, pp. x, 160, \$35.00).
- MILTON F. USRY, ed., *Mary Ball Washington Forum Series in Accounting Education*, (Pensacola: The University of West Florida, 1993, pp. 47).
- STEPHEN VALDEZ, *An Introduction to Western Financial Markets* (New York: New York University Press, 1993, pp. xv, 301, \$40.00).
- JOHN WATTS, *Accounting in the Business Environment* (London: Pitman Publishing, 1993, pp. x, 674).
- GERALD I. WHITE, ASHWINPAUL C. SONDHIL, and DOV FRIED, *The Analysis and Use of Financial Statements* (New York: John Wiley & Sons, Inc., 1994, pp. vii, 1198, \$43.95).

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A synopsis of about 400 words should be presented on a separate page immediately preceding the text. The synopsis also serves as the “introduction.” The synopsis should be nonmathematical and include a readable summary of the research question, method, and the significance of the findings and contribution. The title, but not the author’s name or other identification designations, should appear on the synopsis page.

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- American Accounting Association, Committee on Concepts and Standards for External Financial Reports. 1977. *Statement on Accounting Theory and Theory Acceptance*. Sarasota, FL: AAA.
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- Dye, R., B. Balachandran, and R. Magee. 1989. Contingent fees for audit firms. Working paper. Northwestern University, Evanston, IL.
- Fabozzi, F., and I. Pollack, eds. 1987. *The Handbook of Fixed Income Securities*. 2d ed. Homewood, IL: Dow Jones-Irwin.
- Kahneman, D., P. Slovic, and A. Tversky, eds. 1982. *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge, United Kingdom: Cambridge University Press.
- Porcano, T. M. 1984a. Distributive justice and tax policy. *The Accounting Review* 59 (October): 619–36.
- . 1984b. The perceived effects of tax policy on corporate investment intentions. *The Journal of the American Taxation Association* 6 (Fall): 7–19.
- Shaw, W. H. 1985. Empirical evidence on the market impact of the safe harbor leasing law. Ph.D. dissertation, University of Texas, Austin.
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Governmental Audit Procurement Practices and Seasoned Bond Prices

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SYNOPSIS AND INTRODUCTION: Government auditing standards place strong emphasis on strengthening internal controls and ensuring compliance with laws and regulations.¹ A high quality audit can provide assurance to the municipal bond market that the local government's internal controls and legal compliance are adequate to minimize opportunities for waste and fraud and to assure the continued inflow of federal financial assistance.

Simunic and Stein (1987) suggest that in the capital markets, auditor reputation is made credible by the potential loss of quasi-rents on fixed investments from the failure to deliver the implied audit quality and the subsequent revelation of such failure. Although auditor moral hazard has received some attention in the academic literature, it is perceived to be particularly acute in the government environment. In this environment, the chances of client financial failure and consequent ex post revelation of lower-than-implied audit quality are minimal. Thus, there is a need for alternative mechanisms for enhancing the credibility of the audit. Both the General Accounting Office (GAO 1987) and the American Institute of Certified Public Accountants (AICPA 1987) view appropriate audit procurement practices as a mechanism for ensuring that the contracted audit quality is in fact delivered.

To the extent that management quality is multidimensional, appropriate audit procurement could be viewed as one dimension of the overall quality of administra-

¹ Government auditing standards (GAO 1988) incorporate generally accepted auditing standards (GAAS) by reference but place substantial additional emphasis on the review and evaluation of internal controls and compliance with laws and regulations. Also, the auditor is required to issue a separate report on internal controls and a separate opinion on legal and regulatory compliance. Similar expanded reporting requirements for businesses were discussed during 1991 (Berton 1991a; Committee of Sponsoring Organizations of the Treadway Commission 1991), but appear to have been abandoned due to strong opposition from corporate finance executives (Berton 1991b, 1991c).

We gratefully acknowledge the helpful comments and suggestions of workshop participants at the University of Kansas, University of Kentucky, University of Nebraska, and the University of North Texas. Financial support from the University of North Texas Accounting Department Summer Research Grant Program and the University of Missouri College of Business and Public Administration Summer Research Fellowship Program is gratefully acknowledged.

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tion, or perhaps as part of a larger managerial control dimension. Nonetheless, the GAO and the AICPA suggest that appropriate procurement practices can *independently* contribute to the selection of a competent auditor in a market in which it is difficult to directly assess whether an auditor possesses the specialized knowledge necessary to provide a high quality government audit.

The bond market remains the primary source of (financial) market discipline at the municipal level. In this market, default risk is priced using yield-to-maturity which is a continuous variable. Thus, cities do not have to actually fail for bondholders to suffer capital losses. While information about audit quality may be conveyed by other means (e.g., by size of audit firm), the procurement practices recommended by the GAO (1987) offer the opportunity for additional discrimination in the municipal bond market.

Prior research suggests that two discrete levels of implied audit quality (Big Eight/non-Big Eight) are available in the market for audit services.² However, given the greater risk of auditor moral hazard in the government environment, the traditional Big Eight/non-Big Eight dichotomy is not considered sufficient for differentiating the quality of government audits. The highly specialized knowledge and skills required for government audits results in wide variation in auditor qualifications from firm to firm, and even from office to office within a Big Eight firm. Moreover, the risk of obtaining a low quality audit is relatively high because such audits traditionally have not been easily detected, and only recently have auditors faced significant business risk from providing low quality government audits. Both the GAO and the AICPA have stressed the role of appropriate procurement practices (client monitoring) in mitigating the widespread problem of substandard government audits by CPAs. The purpose of this paper is to evaluate the hypothesis that client monitoring is priced in the seasoned municipal bond market above and beyond other independent measures of local administration quality and the Big Eight/non-Big Eight dichotomy. Our empirical results are generally consistent with the hypothesis, even though the results for a subsample of cities with a Big Eight auditor are also consistent with the auditor competition hypothesis tested by O'Keefe and Westort (1992) and Copley and Doucet (1993).

Key Words: *Audit quality, Audit procurement, Governmental auditing, Municipal bond market.*

Data Availability: *Inquiries regarding data availability should be submitted to the authors with a brief description of its intended uses.*

THE rest of this paper is organized as follows: section I discusses issues related to the quality of governmental audits, the procurement process and seasoned bond prices, and derives testable implications. Section II describes our model and data. Results are presented in section III, and the final section contains a summary of the study and concluding remarks.

I. Government Audit Quality

Under government auditing standards, there is more to an audit than simply the auditor's opinion on the fairness of the financial statements; rather, the objective is to provide assurance

² At the time of our study (1984-87), the eight largest accounting firms had not merged to form the extant Big Six; hence, we refer to these firms as the Big Eight.

about the governmental entity's internal controls and compliance with laws and regulations (Gauthier 1991). In addition to the traditional opinion on the financial statements, the auditor is required to issue a written report on internal controls (including a plan for correcting identified weaknesses) and an opinion on legal compliance.

These additional requirements are motivated primarily by the needs of federal grantors to provide accountability for over \$100 billion of annual assistance. While efficiency and effectiveness in the use of governmental resources is the ultimate goal, generally accepted "bottom-line" measures of efficient and effective performance do not currently exist; rather, adequacy of internal controls and compliance with laws and regulations appear to be viewed as mechanisms for minimizing opportunities for waste and fraud, and for ensuring that federal financial assistance is used only for intended purposes.

In recent years, governmental auditing has become extremely technical and complex (Raman and Wilson 1992). Since audits are performed on a test or sampling basis, "audit risk" (defined, consistent with Statement on Auditing Standards No. 47, as the probability that a clean report will be issued when material errors, control weaknesses, and/or noncompliance actually exist) cannot be reduced to zero except at prohibitive cost. In the government environment, audit quality may be said to possess three dimensions—(1) auditor competence in the form of specialized knowledge of and experience with governmental auditing standards and laws and regulations applicable to grant activities, (2) adequate audit effort in terms of contributing to organization control and reducing audit risk to an appropriately low level, and (3) the reporting of the known material error, internal control weakness, or noncompliance once it is discovered. As posited by the GAO and the AICPA, appropriate procurement practices can improve audit quality on the first two dimensions by ensuring both the selection of a competent auditor and adequate audit effort.

Auditor Moral Hazard

Audits of local governments serve to reduce the information asymmetry between city administrations and outsiders, and to control the moral hazard problem with respect to the actions of local public officials. However, information asymmetry also exists between (1) the auditor and outsiders (including bondholders), and (2) the auditor and the governmental client, with respect to the quality of the audit that is actually delivered.³ Auditor moral hazard has been perceived to be particularly acute in the government environment.

Since governmental bankruptcy is a relatively rare event, the potential for auditor legal liability (in the form of large financial settlements) is correspondingly reduced. Further, citizens are unlikely to sue auditors for losses resulting from fraud and waste in government.⁴ For these reasons, local government audits have been perceived to "pose a minimal risk of liability" (Gauthier 1991, 225). Moreover, the governmental audit market has been characterized by competitive audit pricing practices and, in general, "too great an emphasis on price" in auditor selection (Gauthier 1991, 225). Consequently, federal monitoring of audit reports, oversight (in the form of quality control reviews or QCRs, including a review of work papers), and disciplinary actions, rather than market incentives such as auditors' reputational concerns, are used to control auditor moral hazard in the governmental audit market.

³ The systematic monitoring of practice through peer reviews and continuing professional education (CPE) were identified by the Anderson Committee (AICPA 1986) as institutional devices for achieving adherence to professional standards. Under government auditing standards (GAO 1988), peer reviews and CPE became mandatory in 1991 prior to their becoming mandatory for corporate auditors.

⁴ To our knowledge, to date there have been no taxpayer lawsuits filed against auditors performing substandard governmental audits for damages or recovery of losses.

The results of federal monitoring revealed the widespread problem of substandard audits and, in Congressional hearings, the profession was publicly chastised for "sloppy, unprofessional, substandard CPA audits" (Meinhardt et al. 1987, 86). The GAO (1985, 1986) indicated that substandard audits were being performed by both small and large audit firms (including the Big Eight), although the proportion of substandard audits was lower for the larger firms. However, detailed quality control reviews of completed audits represent a rather costly and ex post approach for assessing auditor compliance with professional standards. Thus, regulatory authorities have viewed client monitoring as enhancing the credibility of the audit and have emphasized audit procurement practices as a timely and cost-effective visible proxy for audit quality.

Procurement as a Mechanism for Enhancing the Credibility of the Audit

The corporate audit literature (e.g., Titman and Trueman 1986; Simunic and Stein 1987) suggests that (1) an entrepreneur can signal favorable private information by selecting a brand name auditor, and (2) the capital markets utilize an audit firm's brand name as a proxy for the probability that the implied audit quality will be delivered. Since the auditor's examination cannot be directly monitored, there is a need for some mechanism for controlling auditor moral hazard (disciplining the auditor). Simunic and Stein (1987) suggest that developing a brand name requires fixed investments and that audit firms who are discovered not living up to their reputation risk losing the future quasi-rents from their fixed investments. Based on Klein and Leffler (1981), they suggest that such fixed investments are essential to make auditor reputation credible to the capital markets. Presumably, all audit firms could potentially be ranked as to their audit quality based on the magnitude of their immovable investments. Absent publicly available data on such fixed investments, prior research has relied on the Big Eight/non-Big Eight distinction as a proxy for audit quality. Melumad and Thoman (1990) suggest, however, that in the absence of litigation the auditor would have little incentive to work hard or report truthfully.

Since the probability of financial failure (and the threat of litigation) is relatively low in the government environment, the chances of discovering that auditors are not living up to their implied audit quality is also correspondingly low. Based on a sample of audit managers and partners from 28 large CPA firms, Raman and Van Daniker (1992, 1994) report that federal oversight/monitoring of audit reports is perceived to be the single most important exposure risk factor in governmental audits. However, federal monitoring in the form of desk and field reviews of audit reports and work papers is costly and subject to cutbacks as a result of budgetary constraints (Deis and Giroux 1992). Hence, in the government environment, there is a need for an alternative mechanism (such as the procurement process) by which the contracted audit quality (and, as we argued earlier, client reputation) can be made credible to the capital markets.

Simunic and Stein (1987) rely on the damage to auditor reputation and consequent loss of quasi-rents as a device for controlling auditor moral hazard; in their theory, there is absolutely no role for client monitoring of the auditor's work. In contrast, both the GAO (1980, 1987) and the AICPA (1987) are strongly encouraging the auditee to select a competent auditor and to monitor subsequent performance, thus increasing the probability that a high quality audit is performed.

We are not aware of any formal theory that specifies the role of procurement practices in controlling the moral hazard of a supplier of professional services to governments.⁵ Since better-

⁵ Due to differences in property rights (and the resulting perception 1. that what belongs to government belongs to everybody and therefore to nobody, and 2. that governments are less likely to sue for damages), governments are perhaps more likely to receive substandard (or overpriced) goods and services (\$600 toilet seats come to mind in this regard). Hence, public sector procurement practices potentially have an important role in monitoring and disciplining suppliers of services to governments. However, this role is yet to be formally specified.

managed cities are perhaps more likely to self-select a high quality audit, it is possible that procurement practices are priced in the seasoned bond market merely as one dimension of the overall quality of local government administration.⁶ Hence, in our empirical analysis we test the significance of the client monitoring process after controlling for the dimensions (features) of administration quality discussed in prior literature.

“Four Critical Attributes” of the Procurement Process

The GAO (1980, 1987) identified “four critical attributes” (competition, solicitation, technical evaluation, and written agreement) of an effective audit procurement process. The four attributes are *not* independent (GAO 1987, 23); hence, the need for incorporating all four in any procurement process.

Competition (i.e., the invitation of bids from at least two firms) is identified as the first of the four critical attributes. In a world where the demand for audit quality varies by client, competition will likely shift the supply curve downward and increase the audit quality purchased by the client. Thus, the mere existence of multiple bidders can potentially increase audit quality (Copley and Doucet 1993; O’Keefe and Westort 1992).

Competition may also enhance audit quality by making the other procurement attributes operative. Without a bidding process, only one auditor is considered and no real selection decision is made. In such a situation, the other requirements (even if they exist on paper) may be inoperative for practical purposes. Also, with a bidding process in place, entities are much more likely “to incorporate the other 3 critical attributes” (GAO 1987, 26).

Solicitation or the use of a written Request for Proposal (RFP) is intended to communicate needs and requirements to audit firms, so that comprehensive proposals include both technical and cost information (including details of work plan, audit hours, and time commitments by staff level). The process of preparing a written RFP can inform both the city administration and the auditor about the nature and the necessary scope of the audit, and the control benefits that can be expected.⁷ The desired audit objectives identified in the RFP can be useful later during the contracting process and in client monitoring of the work performed by the auditor.

Technical evaluation or auditor selection guidelines are necessary for proper evaluation of proposals submitted including the audit firm’s past government experience, qualifications and experience of staff, whether the firm has successfully completed a peer review, etc. A governmental audit’s expanded scope places additional technical burdens on the auditor in the form of specialized knowledge of governmental auditing standards and laws and regulations applicable to federal grant programs. Hence, there is a specific need to screen out CPAs who do not possess the necessary expertise or have not performed satisfactorily on previous engagements.

⁶ Since better-managed cities are more likely to adopt the recommended procurement practices, as we acknowledged in the introduction, we conducted tests to examine the extent of self-selection bias using the Heckman-Lee two-stage switching regression approach discussed in Abdel-khalik (1990a, 1990b), Shehata (1991), and Maddala (1983). Subject to modeling constraints relating to lack of a theoretical model for identifying cities that are more likely to adopt the recommended procurement practices and data limitations, the results of these tests did not indicate self-selection bias to be a problem. Details of these tests have been omitted for the sake of brevity but are available from the authors upon request.

⁷ To quote the Comptroller General of the United States, “... we in government don’t seem to be communicating what we want as effectively as we should. Consequently, ... public accountants ... assume that an audit that is good enough for their commercial clients is good enough for government ... the special requirements the government has put in its audit guides have been regarded disdainfully by CPAs. They don’t see these requirements as necessary to giving an opinion on the financial statements, so they don’t consider them important. To the government, these special requirements may be more important than the CPA’s opinion” (GAO 1980, 8).

Finally, a written agreement or a signed contract incorporating the clearly defined scope of the engagement, specifics of audit work, and other mutual expectations is necessary to ensure the government's ability to monitor, on a timely basis, the audit firm's compliance with the terms of the contract. A written agreement is different from the standard auditor's engagement letter which is designed to protect the auditor rather than the client. Gauthier (1991) notes that governments sometimes find audit firms assigning less-experienced staff to their audits. In such circumstances, a written agreement permits the client to monitor auditor compliance with the terms of the contract, places the auditee in a better position to take recourse against the audit firm in the event the auditor's performance falls short of expectations and otherwise raises the auditor's "business" or exposure risk and potential injury to reputation.⁸

Based on the results of its quality control reviews, the GAO (1987) attempted to establish an "identifiable relationship" between the procurement process and eventual audit quality. Of the audits reviewed, 46 percent were found to be substandard when the procurement process lacked one or more of these four attributes; however, when all four attributes were present in the procurement process only 17 percent were found to be substandard (GAO 1987, 5).

In addition to the four attributes discussed above, the GAO (1987) (1) endorsed the concept of audit committees for both small and large government engagements, and (2) noted that a multiyear agreement (three to five years in length) can provide an audit firm the incentive to devote the necessary time to submit a well-developed proposal. An audit committee and a multiyear agreement were identified by the GAO (1987, 28, 44) as desirable practices over and beyond the "four critical attributes" discussed earlier.

Implications for Seasoned Bond Prices

In the public sector, there are no tradeable equity (ownership) interests and the bond market remains the primary source of (financial) market discipline for local governments. The secondary market in municipal bonds is essential for providing liquidity (marketability) for investors. Pricing in this market establishes a consensus opinion that is important to institutions (and individuals) who invest in municipal bonds and also to local governments in providing a measure of managerial performance.

Since trading in seasoned municipal bonds is relatively thin, the critical function of pricing in this important market is performed by the institutional pricing services.⁹ The exact procedures followed by these pricing services (much like the procedures followed by the rating agencies) are

⁸ As discussed by Brumfield et al. (1983), "business" or exposure risk is the risk of injury to the auditor's reputation as a result of adverse events such as lawsuits resulting from the audit.

⁹ The institutional bond price data used in this study were purchased from Interactive Data Services, Inc., New York, N.Y., a proprietary bond pricing service and subsidiary of Chase Econometrics. The prices are based on mean bid and ask prices determined using an extensive computer matrix pricing system in which issuer default risk determines which of 50 yield curves are assigned to each bond. The yield curves are updated daily for market rates at various terms to maturity. Approximately 1500 issues are priced daily through contacts with dealers and brokers, and the information is used to assist in establishing quasi-prices for similar bonds. Ingram (1985) conducted an exhaustive econometric analysis of these data and concluded that they are closely associated with several market indices and also capture bond rating and accounting-based default risk measures. Ingram (1985) and Ingram et al. (1989) also provide evidence that these price data efficiently reflect issuer-specific accounting information.

It is noteworthy that while the pricing schemes themselves may or may not be perfect, the institutional prices examined in this study are important since they are used extensively (with official sanction from the AICPA, the National Association of Security Dealers, and others) for portfolio pricing by banks, insurance companies, mutual funds, and brokerage houses. These institutional prices are widely used in practice and, for practical purposes, are the only data available for research involving a large number of specific bonds over an extended period of time.

confidential and proprietary, so it is not possible to provide direct evidence that the procurement practices are priced by these services.

The pricing services claim that they incorporate issuer specific data as well as data from actual trades in their decision making.¹⁰ Trading in seasoned municipal bonds is dominated by institutional investors. These institutions have information gathering systems that are well established (e.g., skilled analysts who conduct site visits and other monitoring functions) and the cost of a unit of information for these investors will be relatively low; also, considering the large sums invested, the returns to these investors from obtaining a unit of information will be greater. These incentives allow large investors to be informed above and beyond the data available from annual reports. In turn, information obtained through private search is impounded in prices through trading (Beaver 1989, 12). By incorporating data from actual trades in their matrix pricing procedures, it would appear that the pricing services are willing to learn from observing the actions of other market participants. Raman and Wilson (1990) suggest that these institutional prices are “informative” (that is, impound information) over and beyond the published bond ratings for cities.

Both federal aid grantors and bond investors have similar interests when it comes to audit quality. While the federal government’s primary concern is that assistance to local governments be spent on intended purposes in accordance with the law, bondholders would like federal assistance to continue so as not to diminish operating cash flows available for debt service. Potentially, federal aid can be discontinued if audit reports disclose material weaknesses in internal controls or legal noncompliance. As a practical matter, internal control and compliance deficiencies are likely to be corrected over time as part of the auditor’s required plan of corrective action. Hence, from a longer-run perspective, a high quality audit is likely to provide bondholders the assurance that the administration is competent, that federal aid will continue to be provided, and that governmental resources are being used only for intended purposes. By minimizing opportunities for waste, misuse of resources, and fraud in government, a high quality audit can lower perceived credit risk and raise seasoned bond prices.

Hypotheses

Prior research (e.g., Simunic and Stein 1987) provides evidence that audit firms are perceived as belonging to two quality differentiated types: Big Eight and non-Big Eight. We hypothesize that audit procurement practices can transfer information about actual audit quality over and beyond the Big Eight/non-Big Eight implied levels of audit quality.

Hypothesis 1: In a bond pricing model that pools all cities, the procurement-related variables will provide additional explanatory power beyond the auditor type (Big Eight/non-Big Eight).

Without an observable indicator of implied audit quality, the market will price the seasoned bonds of all cities at the pooling rate. With the availability of auditor brand name as an observable surrogate for implied audit quality, separation by brand name and pooling within each category (Big Eight and non-Big Eight) can be expected. As noted earlier, the GAO (1986) reported that

¹⁰ In a study that compared corporate exchange bond prices to prices from the Merrill Lynch institutional pricing service, Nunn et al., (1986) found that institutional prices were systematically greater and bond returns yielded higher betas and lower standard deviation and residual risk than those from odd-lot exchanges of individual investors. Nunn et al. note that the vast majority of actual trades involve round-lot trades between institutions and that the pricing services are designed specifically to price round-lot activity in the dominant institutional market. Consequently, frequently updated institutional prices may represent the best source of data for research involving specific bonds over an extended period of time.

the larger audit firms were also associated with substandard audits but at a rate lower than that for the smaller audit firms.¹¹ A pure separating equilibrium is therefore unlikely, i.e., not all audits within either the Big Eight or the non-Big Eight pools will be perceived by the market as actually delivering the implied audit quality. Hence, the use of procurement as a mechanism for making auditor reputation credible can be expected to produce further separation within each of the Big Eight and non-Big Eight pools. As noted earlier, the GAO (1987) reported that the use of all "four critical attributes" of the procurement process resulted in a lower (but not zero) rate of substandard audits. Hence, a pure separating equilibrium within either pool is still unlikely.

Hypothesis 2: In a bond pricing model that pools all cities with non-Big Eight audits, the procurement-related variables will provide significant explanatory power, i.e., the market will utilize procurement practices as the basis for separating some non-Big Eight audit cities from other non-Big Eight audit cities.

Hypothesis 3: In a bond pricing model that pools all cities with Big Eight audits, the procurement-related variables will provide significant explanatory power, i.e., the market will utilize procurement practices as the basis for separating some Big Eight audit cities from other Big Eight audit cities.

II. Data Description and Model Development

The audit procurement data for this study were obtained from a mail questionnaire sent to 650 cities with population over 25,000. Of the cities surveyed, 377 were selected on the basis of availability of bond pricing data; the remaining 273 were randomly selected. The questionnaire requested a variety of audit-related data for fiscal years 1984-87. After one follow-up, a total of 351 (54 percent) usable responses were received. However, the requirement in this study that bond data be available, and missing questionnaire data for some years, resulted in a final sample of 124 observations in 1984, 133 in 1985, 139 in 1986, and 143 in 1987, or 539 city-years total.¹² As discussed below, regressions are run on the pooled sample after allowing for structural changes across years 1984-87.

Although the sample is geographically dispersed and includes cities from all population strata (above 25,000), it is somewhat biased toward larger cities. Accordingly, one should be careful in extrapolating the results to all cities.

To test our hypotheses, a yield premium measure was regressed on a group of control variables plus the audit procurement "test" variables.¹³ The model is stated as (see table 1 for definitions of variables):

$$\text{YPREM} = (\text{LOGPOP}, \text{MAT}, \text{COUPON}, \text{AA}, \text{A}, \text{BAA}, \text{MGRFORM}, \text{CERT}, \text{BIG8AUD}, \text{ACOMM}, \text{MYRAGG}, \text{PROCUR}, \text{YR85}, \text{YR86}, \text{YR87}) \quad (1)$$

¹¹ Although the GAO is unwilling to identify CPA firms by name (at least in public), it is known that the Big Eight are represented among firms that have been found to have performed substandard audits.

¹² Of the 539 city-years, 123 cities had observations for all four years, 132 for three years, 139 for two years, and 145 in at least one year. The seasoned bond price data are not for all outstanding bonds of a city, which may be numerous. Rather, budgetary constraints and the high cost of data dictated that we select only one bond per city. The one bond was selected based primarily on the criteria that it was issued by a city over 25,000 in population and that it have the longest available term to maturity and not be callable. The intent of using these criteria was to permit a long time-series of monthly price data to be collected for the same bonds. These data are intended to support a sustained program of research and not just this project.

¹³ This model is similar to 25 municipal bond yield studies reviewed by Cook (1982), modified slightly in consideration that our study examines secondary market yields whereas most prior studies focused on new issue (primary market) yields.

Table 1
Definition of Variables

<i>Variable</i>	<i>Definition</i>
<i>Dependent Variable:</i>	
YPREM	Yield premium defined as the average annual difference between the monthly yield to maturity on each bond and Moody's Aaa 20-year G.O. bond index for the corresponding month.
<i>Independent Variables:</i>	
LOGPOP	Natural logarithm of 1985 population. Source: U.S. Bureau of the Census
MAT	Term to maturity from June of each year to maturity date of each bond, in months. Source: Interactive Data Services, Inc.
COUPON	Coupon interest rate on each bond, in percent. Source: Interactive Data Services, Inc.
Aa, A, Baa	Indicator variables representing Moody's Aa, A, and Baa ratings, respectively (Aaa is the excluded category). Source: Moody's Investors Service, <i>Moody's Bond Record</i> (monthly)
MGRFORM	Form of government (1=council/manager, 0=all others). Source: Questionnaire
CERT	City has earned Government Finance Officers Association's Certificate of Achievement for Excellence in Financial Reporting (1=yes, 0=no). Source: Questionnaire
BIG8AUD	City has Big Eight auditor (now Big Six) (1=yes, 0=no). Source: Questionnaire
ACOMM	Does city use an audit committee? (1=yes, 0=no). Source: Questionnaire
MYRAGG	Was the contract for audit services a multiple year agreement? (1=yes, 0=no). Source: Questionnaire
BID	City solicits bids for auditor procurement (1=yes; 0=no). Source: Questionnaire
RFP	Does city prepare a formal request for proposals for audit services? (1=yes, 0=no). Source: Questionnaire
GLINES	Are formal selection guidelines and criteria used to evaluate proposals for audit services? (1=yes, 0=no). Source: Questionnaire
WCONT	Was a written contract signed with the auditor? (1=yes, 0=no). Source: Questionnaire
PROCUR	Composite audit procurement measure equal to 1 if BID, RFP, GLINES, and WCONT all = 1 (i.e., all four procurement practices being used); 0 otherwise.
YR85, YR86, YR87	Dummy variables indicating observation was for year 1985, 1986, or 1987, respectively (1984 is excluded class)

The dependent variable (YPREM) is the average annual excess of each bond's monthly yield over Moody's 20-year Aaa bond index for the corresponding month. LOGPOP controls for size effects that may proxy for default risk. MAT and COUPON control for duration effects; yields will be higher for bonds of longer maturity and lower for bonds with higher coupon interest rates. Aa, A, and Baa are Moody's bond ratings (Aaa is the excluded class) and broadly control for the default risk class of each bond.

The next three variables control for the quality of management and the brand name auditor effect. MGRFORM and CERT are included as proxies for the professionalism of the chief executive officer (CEO) and quality of financial management. The so-called "reform" governments (those with a council-manager form) have professional managers as their CEO and, on average, should be perceived by bond investors as better managed. Attaining the Certificate of Achievement for Excellence in Financial Reporting (obtained from the Government Finance Officers Association and formerly called the Certificate of Conformance) provides a signalling opportunity for cities with above average financial management. Variables MGRFORM and CERT thus represent two dimensions of administration quality often cited in prior literature (Zimmerman 1977; Evans and Patton 1983, 1987; Benson et al. 1986; Feroz and Wilson 1992). Baskin (1986) and Feroz and Wilson (1992) provide some evidence that interest costs in the primary (new issue) bond market are lower for cities with a Big Eight auditor. We include BIG8AUD to control for the effect of a brand name auditor on yields. All three variables are interesting in their own right; however, our motivation for including them is to facilitate testing whether the audit procurement variables have incremental explanatory power *after* controlling for the dimensions of management quality used in prior studies and the perceived benefits of a brand-name auditor.

To test our hypotheses, we include three variables relating, directly or indirectly, to audit procurement practices. The main test variable, PROCUR, is coded as one if all four key procurement practices identified by the GAO (1987) are being used and coded as zero otherwise. This formulation is consistent with the GAO's (1987) emphasis on the use of all four of the key procurement elements. We also test the effects of two additional variables that the GAO links to quality audits and procurement practices: whether the city has an audit committee (ACOMM) and whether a multiple year agreement (MYRAGG) was signed with the incumbent auditor.

Finally, the period examined (1984-1987) is a period of likely structural change in the municipal bond market. The Tax Reform Act of 1986 changed top corporate and individual tax rates, placed restrictions on certain tax-exempt securities, and imposed arbitrage limitations on earnings from invested bond proceeds.¹⁴ These changes could have impacted tax-exempt bond yields during 1985 in anticipation of the Act, during 1986 as the Act was enacted, or during 1987 as it was implemented. Even though our yield premium is measured relative to a tax-exempt yield index, yield structures by maturity and default risk may have shifted due the Act.

We also expect that the increased emphasis of the GAO over the 1984-1987 period to improve the quality of governmental audits may have produced temporal shifts in both the quality of audit practices and sensitivity of the bond market to audit quality issues. If so, the association between yields and procurement practices may exhibit a shift over time. To control for intercept shifts, due either to the Tax Reform Act or to changes in audit quality perceptions, we use the procedure recommended by Johnson et al. (1987, 198-201) by including dummy variables for the years 1985, 1986, and 1987 (1984 is the excluded class).¹⁵ As Johnson et al. argue, structural changes,

¹⁴ See Petersen (1987) for a full discussion of the implications of the Tax Reform Act of 1986 for municipal bonds.

¹⁵ Interactions between PROCUR and dummy variables for different years indicated no structural shifts in slope, even though intercept shifts were noted, as reported in our results. For brevity, the interaction variables were not included in the model.

if uncontrolled, may produce insignificant test results when a significant association actually exists.¹⁶

In summary, our model controls for size of city, bond-specific attributes, default risk class, market risk pricing, quality of management, brand name auditor effect, and structural change effects. As such it permits a test of whether audit procurement practices incrementally explain yield premiums on seasoned bonds, after controlling for traditional measures of management and audit quality. Since the dependent variable YPREM is defined as a yield premium measure, it effectively controls for intertemporal differences in market interest rates.

III. Test Results

Table 2 provides the mean and standard deviation for all variables, both for the full sample and subsamples split by type of auditor, Big Eight vs. non-Big Eight. Partitioning by type of auditor is consistent with our hypotheses which test whether procurement practices affect yields *within* type of auditor. The mean yield premium (YPREM) is consistently negative indicating that on average Moody's Aaa yield index is larger than the yields on the bonds in our study. This result is not surprising since the Moody's index is for 20-year bonds whereas the average maturity of our sample is only 10.8 years (129.3 months). Unlike corporate bond yields, municipal yield curves are invariably upward sloping. The lower average yield premium of -0.279 for the non-Big Eight subsample compared with -0.173 for the Big Eight subsample is attributable, in part, to its 9.6 year average maturity compared with 11.6 years for the Big Eight sample. Significant size differences between the two subsamples may also explain the yield premium difference; many larger cities have faced severe economic and social difficulties. To control for size and term to maturity differences, we specifically include population (LOGPOP) and maturity (MAT) in our subsequent regressions.

Table 2 also shows that cities that are audited by a Big Eight auditor (average population of 239,031) are nearly triple the average size of those audited by a non-Big Eight auditor (average population of 87,203). Those with a Big Eight auditor also have slightly higher bond ratings (RATING of 2.49 compared with 2.28 for the non-Big Eight subsample) and are slightly more likely to have a council-manager form of government (MGRFORM of 60.8% compared with 56.9%). Similarly, 65.6% of cities audited by a Big Eight auditor had been awarded the Certificate of Achievement for Excellence in Financial Reporting compared with 41.8% for those audited by a non-Big Eight auditor.

Of main interest to our study are the procurement related variables ACOMM, MYRAGG, BID, RFP, GLINES, and WCONT. The latter four variables are the component variables of PROCUR which has a value of "1" if all four of the procurement practices are used and a value of "0" if one or more is not used. Table 2 indicates that less than one-fourth of the cities (23.7%) are using all four of the audit procurement practices recommended by the GAO, although the percentage is somewhat higher for cities which use a Big Eight auditor. However, only the use of an audit committee (ACOMM) significantly differed between type of auditor groups ($p < 0.05$).

¹⁶ Since most cities have an observation for each of the four years 1984-1987, an econometric concern is that the residuals among the four years may be correlated, which could produce biased and inconsistent parameter estimates. To examine this concern, we ran separate regressions for each year and measure the bivariate correlations among the vectors of residuals of each year. Only the residuals for years 1985 and 1986 were significantly correlated and that was only moderate ($r=0.11$). Moreover, we utilized generalized least squares (see Judge et al. 1985, 466-471) to jointly estimate a system of four separate models corresponding to each year and the results were virtually identical to those reported in section III. This procedure incorporates the full variance-covariance matrix among residuals of the four models, thus indicating that intertemporal correlation is not a significant problem. Our use of dummy variables to capture structural shift may also mitigate this concern.

Table 2
Descriptive Statistics for all Variables

Variable	Full Sample (n=539)		Big Eight Subsample (n=314)		Non-Big Eight Subsample (n=225)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
<i>Dependent Variable:</i>						
YPREM	-0.217	0.591	-0.173	0.586	-0.279	0.593
<i>Independent Variables:</i>						
POP (a)	175.652	333.597	239.031	413.289	87.203	122.982
MAT	129.299	55.858	139.274	60.193	115.378	45.791
COUPON	4.990	1.011	4.884	0.977	5.138	1.039
RATING (b)	2.403	0.813	2.490	0.851	2.280	0.742
MGRFORM	0.592	0.492	0.608	0.489	0.569	0.496
CERT	0.557	0.497	0.656	0.476	0.418	0.494
BIG8AUD	0.583	0.494	—	—	—	—
ACOMM	0.286	0.452	0.338	0.474	0.213	0.411
MYRAGG	0.458	0.499	0.481	0.500	0.427	0.496
BID	0.390	0.488	0.392	0.489	0.387	0.488
RFP	0.377	0.485	0.392	0.489	0.351	0.478

(Continued)

Table 2 (Continued)

Variable	Full Sample (n=539)		Big Eight Subsample (n=314)		Non-Big Eight Subsample (n=225)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
GLINES	0.417	0.494	0.436	0.497	0.391	0.489
WCONT	0.612	0.488	0.627	0.484	0.591	0.493
PROCUR	0.237	0.426	0.252	0.435	0.218	0.414

Notes: (a) Population is shown in thousands of persons. The raw measure is used for descriptive purposes only; the logarithmic form is used in the regressions.
(b) Moody's bond rating is shown in ordinal form (1=Baa, 2=A, 3=Aa, 4=Aaa) for descriptive purposes only; the regressions use dummy variables to represent rating categories, as described in table 1.

Table 3
Spearman Rank Correlations for All Independent Variables
Used in the Basic Model (N=539)

<i>Variable^a</i>	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
YPREM (X1)	1.00														
LOGPOP (X2)	.20	1.00													
MAT (X3)	.80	.22	1.00												
COUPON (X4)	.02	-.27	.05	1.00											
RATING (X5)	-.33	.20	-.03	-.17	1.00										
MGRFORM (X6)	-.13	-.08	-.09	-.23	.07	1.00									
CERT (X7)	-.06	.29	.10	-.13	.32	.27	1.00								
BIG8AUD (X8)	.10	.33	.21	-.14	.13	-.04	.24	1.00							
ACOMM (X9)	.04	.11	.15	-.15	.12	-.01	.07	.14	1.00						
MYRAGG (X10)	-.17	-.03	-.15	-.08	.10	.20	.06	.05	.05	1.00					
BID (X11)	-.18	.04	-.11	.09	-.01	-.01	-.01	.01	.13	.36	1.00				
RFP (X12)	-.12	.02	-.11	.03	.05	.01	.00	.04	.23	.45	.56	1.00			
GLINES (X13)	-.08	.07	-.01	.08	.06	.01	.13	.04	.24	.35	.48	.70	1.00		
WCONT (X14)	-.09	.11	-.07	.01	.07	.03	.16	.04	.17	.27	.23	.46	.54	1.00	
PROCUR (X15)	-.11	.13	-.11	.10	.01	-.06	.02	.04	.19	.39	.70	.72	.66	.44	1.00

Notes: (a) See table 1 for description of variables. Correlations of approximately .086 or larger are significant at the .05 level.

Table 4
Regression Results for Full Sample Model and Type of Auditor Models
(Dependent variable is YPREM)

Variable	Predicted Sign	Full Sample Model (n=539)		Type of Auditor			
		Coef.	t-stat.	Big 8 Model (n=314)		Non-Big 8 Model (n=225)	
Intercept	?	-1.2191	-8.44	-1.2572	-6.77	-1.9731	-6.70
LOGPOP	?	0.0523	2.94***	0.0418	2.06**	0.1462	3.54***
MAT	+	0.0073	24.20***	0.0066	18.88***	0.0090	15.34***
COUPON	-	-0.0658	-4.10***	-0.0489	-2.29**	-0.0466	-1.81**
AA	+	0.2195	3.85***	0.2326	3.66***	0.2858	2.42**
A	+	0.3917	6.81***	0.3764	5.73***	0.5025	4.34***
BAA	+	0.6715	9.67***	0.7489	8.90***	0.6906	5.26***
MGRFORM	-	-0.0527	-1.54*	-0.0491	-1.11	-0.0453	-0.77
CERT	-	-0.0588	-1.70**	0.0054	0.12	-0.1607	-2.60***
BIG8AUD	-	-0.0586	-1.75**	—	—	—	—
ACOMM	-	0.0079	0.23	0.0520	1.27	-0.0553	-0.89
MYRAGG	-	0.0147	0.43	0.0165	0.39	0.0073	0.12
PROCUR	-	-0.0850	-2.12**	-0.1477	-3.01***	-0.0121	-0.16
YR85	?	-0.0467	-1.08	-0.0423	-0.79	-0.0296	-0.43
YR86	?	-0.0634	-1.46	-0.0793	-1.46	-0.0058	-0.08
YR87	?	-0.1617	-3.67***	-0.1579	-2.92***	-0.1196	-1.62
Adj. R-square		0.658		0.692		0.631	
Model F-Value		69.926***		51.293***		28.371***	
Df		(15,523)		(14,299)		(14,210)	

Levels of Significance: (One-tailed test unless sign indicated by ?)

* p < 0.10 ** p < 0.05 *** p < 0.01

Multicollinearity is not considered a significant problem since the bivariate correlations shown in table 3 appear to be low to moderate, except, as expected, among the procurement practice variables. Variance inflation factors (VIFs) for all variables are quite low, as are the eigenvalue ratios (condition indexes) for the principal components.¹⁷ Examination of studentized residuals and Cook's D indicated that the results are not being affected by influential outliers. Finally, White's (1980) test and residual plots indicated no problems with heteroscedasticity.

Table 4 displays the OLS regression results for the full sample (basic model) and for subsamples partitioned by type of auditor, Big Eight and non-Big Eight. The variables with the most explanatory power are those capturing bond-specific and market attributes, although the size of the city (LOGPOP) was also significantly positive in all models. Term to maturity (MAT), coupon interest rate (COUPON), and the bond rating variables are all highly significant in the predicted directions. The coefficients on CERT and BIG8AUD indicate that yields are significantly lower for cities with a GFOA Certificate of Achievement ($p < 0.05$ in the basic model and $p < 0.01$ in non-Big Eight model) and for those with a Big Eight Auditor ($p < 0.05$ in the full sample model). In addition, the form of government (MGRFORM) is marginally significant ($p < 0.10$) in the full sample model.

A strong structural shift is observed in the year 1987 in the full sample model, even though it appears that the shift is driven by the Big Eight subsample. Yield premiums are significantly lower in 1987 than in the other years. As discussed earlier, this shift may be due to the Tax Reform Act of 1986 or to other factors such as the strong efforts of the GAO, AICPA, and others to improve governmental audits during the periods examined. We consider a shift in yields for different maturities due to the Tax Reform Act as the most likely explanation for the observed shift, particularly since we tested and found no interaction effect between PROCUR and the dummy year variables.

Our main interest is with the procurement-related variables ACOMM, MYRAGG, and PROCUR. As shown in the basic model, neither ACOMM nor MYRAGG are significant; however, PROCUR is significantly associated with YPREM in the expected direction at the 0.05 level.¹⁸ Thus, procurement factors appear to have an incremental effect on yields, above and beyond traditional measures of management quality (MGRFORM and CERT) and audit quality (BIG8AUD).

Hypotheses 2 and 3 posit that audit procurement practices will also mediate yields *within* auditor type groupings. To test these hypotheses, we ran the regressions on separate subsamples partitioned by type of auditor, Big Eight vs. non-Big Eight. As shown in table 4, within the Big Eight grouping, procurement practices have an even stronger association with yields than they did in the basic model (t-ratio of 3.03 compared with 2.14 for the basic model). Even though

¹⁷ The variance inflation factor is the reciprocal of 1 minus the R-square when a particular independent variable is regressed on all other independent variables. The condition index is defined as the square root of the ratio of the largest eigenvalue to that for each individual principal component of the cross products matrix. See Belsley et al. (1980) for a discussion of these diagnostic approaches. The highest VIFs were 3.7 and 3.4 for the A and Aa rating variables. None of the audit-related variables had VIFs in excess of 2.0 in magnitude, much lower than the level of 10.0 that Marquardt (1970) suggests as an indication of a serious multicollinearity problem. Also, the principal components on which the audit-related variables loaded had condition indexes less than 8.0 in magnitude. Even though no guidelines were found in the literature for the condition index, these values appear relatively low compared with those observed for data used in other studies by the authors.

¹⁸ In addition, the regressions were run with PROCUR defined as a sum variable having value of "0" to "4" depending on the number of procurement practices being used. The results were similar to those shown, except that the significance level was stronger using the sum variable ($p < 0.01$).

Table 5
Regression Results for Disaggregated Audit Procurement Factors
Full Sample Model and Type of Auditor Models
(Dependent variable is YPREM)

Variable	Predicted Sign	Type of Auditor					
		Full Sample Model (n=539)		Big 8 Model (n=314)		Non-Big 8 Model (n=225)	
		Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
Intercept	?	-1.23318	-8.653	-1.3525	-7.22	-1.8905	-6.40
LOGPOP	?	0.0565	3.23***	0.0583	2.78***	0.1152	2.68***
MAT	+	0.0072	24.18***	0.0063	18.19***	0.0092	15.38***
COUPON	-	-0.0619	-3.90***	-0.0359	-1.67*	-0.0458	-1.79**
AA	+	0.2507	4.40***	0.2673	4.20***	0.3089	2.65***
A	+	0.4076	7.17***	0.3886	6.00***	0.5434	4.79***
BAA	+	0.7125	10.25***	0.7590	9.13***	0.7260	5.51***
MGRFORM	-	-0.0501	-1.49*	-0.0293	-0.66	-0.0310	-0.53
CERT	-	-0.0554	-1.59*	-0.0062	-0.14	-0.1309	-2.17**
BIG8AUD	-	-0.0636	-1.92**	—	—	—	—
ACOMM	-	0.0033	0.09	0.0414	1.00	-0.1225	-1.83**
MYRAGG	-	0.0281	0.80	0.0645	1.46	0.0352	0.57
BID	-	-0.1712	-4.42***	-0.2032	-3.89***	-0.1190	-1.88**
RFP	-	0.0567	1.21	-0.0440	-0.75	0.2492	3.03
GLINES	-	0.0013	0.28	0.0645	1.15	-0.1730	-2.11**
WCONTR	-	-0.0340	-0.92	-0.0396	-0.86	-0.0006	-0.01
YR85	?	-0.0466	-1.09	-0.0551	-1.03	-0.0336	-0.50
YR86	?	-0.0630	-1.47	-0.0772	-1.44	-0.0254	-0.37
YR87	?	-0.1630	-3.75***	-0.1663	-3.12***	-0.1207	-1.67*
Adj. R-square		0.666		0.703		0.648	
Model F-Value		60.710***		44.521***		25.199***	
Df		(18,520)		(17,296)		(17,207)	

Levels of Significance: (One-tailed test unless sign indicated by ?)

* p < 0.10 ** p < 0.05 *** p < 0.01

PROCUR was not significant within the non-Big Eight grouping, additional analysis, as we explain shortly, indicates that three of the four component variables of PROCUR do marginally explain a significant portion of the variance in yield premiums.

We also examine the effects of the four component variables that constitute PROCUR: these variables are BID, RFP, GLINES, and WCONT, as defined in table 1. Table 5 presents the results for the disaggregated procurement variables models. All results for the control variables and structural shift variables are similar to those reported in table 4. Of the four procurement variables, only BID is significant in all models presented in table 5. However, both BID and GLINES are significant in the expected direction in the non-Big Eight model. In addition, having an audit committee (ACOMM) is significant. Interestingly, preparing a request for proposals (RFP) is strongly significant with an unexpected positive sign. We are unable to explain the unexpected sign for RFP. Analysis of the bivariate correlation of RFP with YPREM showed a significant ($p < 0.01$) negative correlation, as expected, in the full sample and a subsample of cities audited by a Big Eight auditor. Interestingly, neither RFP nor BID were significantly correlated with YPREM in the non-Big Eight subsample. Also, when RFP is included in a regression with the other procurement-related variables excluded, it is significant with a negative sign in the Big Eight subsample but is not significant in the non-Big Eight subsample. Thus, it appears that the positive sign results from some pattern of interaction between RFP and the other three procurement variables. The positive association for RFP in the non-Big Eight subsample likely offsets the negative associations for BID and GLINES, producing an overall insignificant effect for the variable PROCUR in table 4.

Various interpretations can be made from the results in tables 4 and 5. The most reasonable interpretation is that, for the subsample of cities audited by a Big Eight auditor, the results for PROCUR are being driven by the competition variable BID. This result is consistent with that of Copley and Doucet (1993) who find a positive association between competition (number of bids received) and a measure of audit quality. As a stronger test for the effects of BID alone, we attempted to run the regression on a subsample of cities in which BID existed but the other three practices did not exist. Unfortunately, that subsample contained only 19 observations corresponding to five cities and thus was too small to be useful.

On the other hand, the results for the non-Big Eight subsample indicate that audit procurement variables other than BID (RFP and GLINES) explain a significant portion of the variation in YPREM, even though the sign for RFP is inexplicably opposite that expected. In addition, having an audit committee (ACOMM) is significant in the non-Big Eight subsample. To further test the incremental contribution of the three procurement variables other than BID (RFP, GLINES, and WCONT), we conducted an F-test of the joint contribution of those variables beyond that of BID alone. The F value for this test was 3.37 with a p-value of 0.019, thus indicating that, for cities audited by a non-Big Eight auditor, procurement variables other than competition (BID) alone are significant. In addition, a joint F-test of the four component variables of PROCUR as a group was highly significant (F-value=3.74, 4/208 df, $p = .0058$). A joint F-test of these four variables and ACOMM and MYRAGG was also significant ($p = .0165$).

The results for GLINES and ACOMM in the non-Big Eight model are of particular interest. Potentially, there is greater heterogeneity in audit quality within the non-Big Eight group than within the Big Eight group. In general, while the Big Eight are perceived as having a brand name reputation for performing quality audits, there is a lack of reputational measures to differentiate between non-Big Eight auditors. The GAO (1985, 1986) suggests that small audit firms are more likely to perform substandard audits. Hence, it is not surprising that the use of technical evaluation (auditor selection) guidelines (GLINES) is of greater importance in pricing the bonds of cities

with non-Big Eight auditors.¹⁹ Similarly, having an audit committee appears to be more important for this group; that is, an audit committee is perceived as more likely to conduct an objective technical evaluation of audit bids than is a panel of in-house officials.

In general, while all audit firms are expected to adhere to government auditing standards, the non-Big Eight may be perceived as having a reputation only for meeting rather than exceeding minimum professional standards.²⁰ Further, since reliance on procurement practices implies reliance on the auditee to select a competent auditor and to monitor the audit, the effectiveness of procurement practices will likely be more significant within the non-Big Eight group where greater quality variation has been observed. For these reasons, procurement as a mechanism for enhancing perceived audit quality could be more effective, as the results seem to imply, for non-Big Eight auditors.

In summary, our results are consistent with hypotheses 1 and 3, but not with hypothesis 2 when using the dichotomous variable PROCUR. As table 5 shows, however, when PROCUR is disaggregated into its four component variables, the results show that for cities audited by a Big Eight auditor procurement effects beyond competition (BID) do not appear to be priced by the bond market. This finding is consistent with O'Keefe and Westort (1992) and Copley and Doucet (1993). As discussed in section I, auditor competition is expected to enhance audit quality by shifting the supply curve downward and allowing the other procurement attributes to come into play. In addition, when non-Big Eight auditors are selected, having an audit committee and formal technical evaluation standards seem to signal differentiated audit quality to the bond market. It would appear that it is the *ex ante* attributes of procurement rather than the *ex post* effect of monitoring which affect auditor moral hazard and thus audit quality, although we have no means of testing this supposition directly.

IV. Summary and Conclusions

In the government audit environment, characterized by unique auditor knowledge and skill requirements but low business risk, auditor moral hazard is perceived to be a particularly significant problem. As an alternative to the costly *ex post* quality control reviews (QCRs) of local government audits, the GAO (1987) and the AICPA (1987) have recommended audit procurement practices as a mechanism for selecting a competent auditor and for controlling auditor moral hazard.

Our study examined whether the "four critical attributes" of the audit procurement process identified by the GAO (1987) were priced in the market for seasoned general obligation bonds. Due to differences in property rights between the public and corporate sectors, procurement practices in the public sector potentially have an important role in monitoring and disciplining a supplier of professional services to governments. Appropriate procurement practices can help a governmental client in becoming an informed consumer of audit services, in selecting a competent supplier, in clarifying audit objectives, and in increasing the supplier's exposure risk

¹⁹ As pointed out by an anonymous reviewer, our dichotomous GLINES variable is a rather coarse measure since it ignores the potential variation in the weights attached to the various technical selection criteria (GAO 1987). The statistical significance of this measure, despite its coarseness, underlines the importance of this particular procurement attribute in the context of a non-Big Eight auditor.

²⁰ Minimum professional standards, in terms of quantitative guidelines for materiality or the "appropriately" low level of audit risk, are undefined. Given the greater risk of auditor moral hazard in governmental audits, Raman and Van Daniker (1992, 1994) suggest that the need for quantitative guidelines is much greater in governmental auditing than in corporate auditing. The capital markets may perceive the Big Eight as having a reputation for services that imply greater precision (lower materiality) and higher assurance (lower audit risk) than what is necessary to satisfy GAAS. Also, Baskin (1986) provides some evidence that the use of a non-Big Eight auditor is perceived negatively by municipal bond analysts.

by spelling out expectations in writing. Procurement could serve as a mechanism for making credible in the bond market the contracted audit quality at least in regard to the implied (reputed) control benefits from the audit. This argument provided the rationale for the hypothesis that procurement practices can transfer information about actual audit quality and have an incremental effect on yields above and beyond the implied audit quality (Big Eight/non-Big Eight) effect. Similarly, it was argued that procurement practices would explain variation in yields *within* implied audit quality groupings: Big Eight vs. non-Big Eight.

The extant (corporate) academic literature (e.g., Simunic and Stein 1987) does not allow any role for client monitoring of the audit in a theory of auditor moral hazard. However, by emphasizing procurement practices, the GAO and the AICPA are relying on client monitoring as a mechanism for controlling auditor moral hazard in governmental audits. Government auditing standards emphasize control benefits as an audit service characteristic. Hence, client monitoring can be a plausible mechanism for reducing auditor moral hazard, particularly if the client is well-managed and is motivated to obtain the full control benefits contracted for in the audit.

Since the precise details of the pricing process followed by institutional investors and pricing services are confidential and proprietary, it is not possible to provide direct evidence that procurement practices are priced in the seasoned bond market. Also, the research design and statistical methods used in this study do not permit us to infer a causal relationship between procurement practices and bond yields. However, our argument of pricing by the institutional services (through matrix pricing and learning by observing the activities of other market participants) provides a reasonable basis to expect an association between these practices and yields. Even if some investors are unaware of the procurement practices of individual cities, it is sufficient that influential market agents (e.g., institutional investors and the institutional pricing services) consider such factors in evaluating seasoned bond prices.

The results are generally consistent with our hypotheses, in that procurement practices were significant within both the Big Eight subsample and the non-Big Eight subsample, with more of the practices significant in the latter subsample. Competition for audit services alone appears to be the significant procurement benefit for cities that are audited by a Big Eight auditor. Overall, the results indicate that procurement practices explain a statistically significant amount of yields after controlling for traditional measures of management and audit quality used in prior studies. Thus, the results provide some support for the GAO's contention that procurement practices have an important role in controlling auditor moral hazard in the public sector.

References

- Abdel-khalik, A. 1990a. The jointness of audit fees and demand for MAS: A self-selection analysis. *Contemporary Accounting Research* 6 (Spring): 295-322.
- . 1990b. Specification problems with information content of earnings: Revisions and rationality of expectations and self-selection bias. *Contemporary Accounting Research* 7 (Fall): 142-172.
- American Institute of Certified Public Accountants. 1986. *Restructuring Professional Standards to Achieve Professional Excellence in a Changing Environment*. New York, NY: AICPA.
- . 1987. *Report of the Task Force on the Quality of Audits of Governmental Units*. New York, NY: AICPA.
- Baskin, S. 1986. The information content of the audit report as perceived by municipal analysts. *Research in Governmental and Nonprofit Accounting* 2: 53-88.
- Beaver, W. 1989. *Financial Reporting: An Accounting Revolution*. Englewood Cliffs, NJ: Prentice Hall.
- Belsley, D., E. Kuh, and R. Welsch. 1980. *Regression Diagnostics*. New York, NY: John Wiley & Sons.
- Benson, E., B. Marks, and K. Raman. 1986. The certificate of conformance and municipal borrowing costs. *Advances in Accounting* 3: 221-232.

- Berton, L. 1991a. Accounting, financial organizations to release guidelines on curbing fraud. *The Wall Street Journal* (March 12): C23
- . 1991b. This bill puts whistles in the right hands. *The Wall Street Journal* (September 3): A18.
- . 1991c. FEI withdraws support of revised fraud-report bill. *The Wall Street Journal* (October 9): A7.
- Brumfield, C., R. Elliott and P. Jacobson. 1983. Business risk and the audit process. *Journal of Accountancy* 166 (April): 60-68.
- Cook, T. 1982. Determinants of individual tax-exempt bond yields: A survey of the evidence. *Economic Review* (May/June): 14-39.
- Committee of Sponsoring Organizations of the Treadway Commission (COSO). 1991. Exposure Draft. *Internal Control—Integrated Framework*. New York, NY: COSO.
- Copley, P., and M. Doucet. 1993. The impact of competition on the quality of governmental audits. *Auditing: A Journal of Practice & Theory* 12 (Spring): 88-98.
- Deis, D., and G. Giroux. 1992. Determinants of audit quality in the public sector. *The Accounting Review* 67 (July): 462-479.
- Evans, J., and J. Patton. 1983. An economic analysis of participation in the municipal finance officers association certificate of conformance program. *Journal of Accounting and Economics* 6 (1983): 151-175.
- , and ———. 1987. Signalling and monitoring in public sector accounting. *Journal of Accounting Research* 25 (Supplement): 130-158.
- Feroz, E., and E. Wilson. 1992. Market segmentation and the association between municipal financial disclosure and net interest costs. *The Accounting Review* 67 (July): 480-495.
- Gauthier, S. 1991. Auditing. In *Local Government Finance: Concepts and Practices*, edited by J. Petersen and D. Strachota. Chicago, IL: Government Finance Officers Association.
- General Accounting Office. 1980. *The Procurement & Performance of Audits Of Government Organizations & Programs*. Washington, D.C.: GAO.
- . 1985. *CPA Audit Quality: Inspectors General Find Significant Problems*. Washington, D.C.: GAO.
- . 1986. *CPA Audit Quality: Many Governmental Audits Do Not Comply With Professional Standards*. Washington, D.C.: GAO.
- . 1987. *CPA Audit Quality: A Framework for Procuring Audit Services*. Washington, D.C.: GAO.
- . 1988. *Standards For Audit of Governmental Organizations, Programs, Activities and Functions*. Washington, D.C.: GAO.
- Ingram, R. 1985. A descriptive analysis of municipal bond price data for use in accounting research. *Journal of Accounting Research* 23 (Autumn): 595-618.
- , K. Raman, and E. Wilson. 1989. The information in governmental annual reports: A contemporaneous price reaction approach. *The Accounting Review* 64 (April): 250-268.
- Johnson, A., M. Johnson, and R. Buse. 1987. *Econometrics*. New York, NY: McMillan Publishing Co.
- Judge, G., W. Griffiths, R. Hill, H. Lutkepohl, and T. Lee. 1985. *The Theory and Practice of Econometrics*. New York, NY: John Wiley and Sons.
- Klein, B., and K. Leffler. 1981. The role of market forces in assuring contractual performance. *Journal of Political Economy* (1981): 615-641.
- Maddala, G. 1983. *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge, U.K.: Cambridge University Press.
- Marquardt, D. 1970. Generalized inverses, ridge regression, biased linear estimation and nonlinear estimation. *Technometrics* 12 (August): 591-612.
- Meinhardt, J., J. Moraglio, and H. Steinberg. 1987. Governmental audits: An action plan for excellence. *Journal of Accountancy* 170 (July): 86-91.
- Melumad, N., and L. Thoman. 1990. On auditors and the courts in an adverse selection setting. *Journal of Accounting Research* 28 (Spring): 77-120.
- Nunn, K., J. Hill, and T. Schneeweis. 1986. Corporate bond price data sources and return/risk measurement. *Journal of Financial and Quantitative Analysis* (June): 197-208.

- O'Keefe, T., and P. Westort. 1992. Conformance to GAAS reporting standards in municipal audits and the economics of auditing: The effect of audit firm size, CPA examination performance, and competition. *Research in Accounting Regulation*: 39-77.
- Petersen, J. 1987. *Tax-Exempts and Tax Reform: Assessing the Consequences of the Tax Reform Act of 1986 for the Municipal Securities Market*. Chicago, IL: Government Finance Officers Association.
- Raman, K., and R. Van Daniker. 1992. *Materiality and Audit Risk in Governmental Auditing*. Alexandria, VA: Association of Government Accountants (AGA) Research and Education Foundation.
- , and ———. 1994. Materiality in government auditing. *Journal of Accountancy* 177 (February): 71-76.
- , and E. Wilson. 1990. The debt equivalence of unfunded governmental pension obligations. *Journal of Accounting and Public Policy* 9 (Spring): 37-56.
- , ———. 1992. An empirical investigation of the market for single audit services. *Journal of Accounting and Public Policy* 11 (Winter): 271-296.
- Shehata, M. 1991. Self-selection bias and the economic consequences of accounting regulation: An application of two-stage switching regression to SFAS No. 2. *The Accounting Review* 66 (October): 768-787.
- Simunic, D., and M. Stein. 1987. *Product Differentiation in Auditing: Auditor Choice in the Market for Unseasoned New Issues*. Vancouver, Canada: The Canadian Certified General Accountants' Research Foundation.
- Titman, S., and B. Trueman. 1986. Information quality and the valuation of new issues. *Journal of Accounting and Economics* 9 (June): 159-172.
- White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48: 817-838.
- Zimmerman, J. 1977. The municipal accounting maze: An analysis of political incentives. *Journal of Accounting Research* 15 (Supplement): 107-144.

Efficient and Opportunistic Choices of Accounting Procedures: Corporate Control Contests

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SYNOPSIS AND INTRODUCTION: Accounting numbers are an integral part of the firm's formal and informal contracts (Watts 1974; Holthausen and Leftwich 1983; Watts and Zimmerman 1986; Ball 1989; Christie 1990). This contracting-based theory of accounting is based on the premise that managers choose particular accounting procedures either efficiently to maximize the value of the firm, or opportunistically to make the manager better off at the expense of some other contracting party (Holthausen 1990). The relative amounts of efficiency and opportunism depend on controls on managers' accounting discretion. Such controls include monitoring by the board of directors, competition from the product markets and from within the firm by other managers, and the discipline of the market for corporate control.

It is difficult to determine whether managers make accounting choices to maximize firm-value. Empirical tests often assume opportunism and usually reject the null hypothesis of no association between accounting choice and firm-specific variables such as leverage (Christie 1990). However, many of the empirical regularities interpreted as evidence of opportunism can also be interpreted as occurring for efficiency reasons, which serves to confound these findings (Watts and Zimmerman 1986; Watts and Zimmerman 1990; Sweeney 1994). The few tests based on efficiency rationales find an association between the contracting variables and accounting choice (Zimmer 1986; Whittred 1987; Malmquist 1990; Mian and Smith 1990a).

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This paper measures the relative influences of efficiency and opportunism in accounting choice by examining a non-random sample that maximizes the probability of finding opportunism. Economics and finance studies document that corporate control actions such as tender offers and proxy fights discipline opportunistic managers. Therefore, we select a sample of takeover targets and examine this sample for evidence of managerial opportunism in choice of accounting procedures. A key assumption of our tests is that, prior to the control action, corporate control targets contain more non-value-maximizing managers than surviving firms in the same industry that were not targets of corporate control actions. This assumption allows us to use surviving firms' accounting procedures as the benchmark for the efficient accounting choice. In this application of Alchian's (1950) "economic Darwinism," surviving firms on average are more efficient than non-surviving firms. An unbiased estimate of accounting opportunism in this sample is an estimate of the upper bound on the amount of accounting opportunism in a random sample of firms. If there is little or no opportunism in our non-random sample, then for firms generally we can discount opportunism as an explanation for choice of the three accounting methods we study. Efforts to explain choice of accounting methods could then be redirected towards efficiency explanations.

We measure opportunism by comparing the frequency of choice of income-increasing procedures by takeover targets with the corresponding frequency of their surviving industry peers. We find that takeover targets select income-increasing depreciation, inventory, and investment tax credit (ITC) accounting methods more frequently than their surviving industry peers in up to 11 years preceding the control action. Our analysis includes a multiple regression that controls for efficient choice of accounting methods.

Our estimate of the upper bound on the frequency of opportunism is small relative to the mean choices of surviving firms. We conclude that some accounting opportunism exists in the takeover targets, but that efficiency is the more important explanation of accounting choice. However, while the frequency of opportunism is relatively small, the dollar effect on retained earnings of selecting an income-increasing method is large. For the median target firm, the after-tax effect on retained earnings if the firm had been on the alternative method is about 26 percent for depreciation, 9 percent for inventory, and around 5 percent for the ITC.

Key Words: *Accounting choice, Depreciation, Inventory, Investment tax credit, Takeovers, Efficiency, Managerial opportunism.*

Data Availability: *Data on takeovers are provided by Robert Comment.*

THE next section discusses efficient and opportunistic accounting choices. Section II describes the sample selection procedures and our benchmarks for efficient choice. Descriptive statistics on the samples are presented in section III. The results of the tests are contained in section IV, while section V summarizes the paper and provides some caveats.

I. Efficient and Opportunistic Accounting Choices

Determining the relative influence of efficiency and opportunism as factors affecting managers' accounting choices requires precise definitions of these terms. This section provides these definitions.

When organizing or reorganizing a firm, the contracting parties (including managers and outside claim holders) agree on the set of contracts that divide the firm's cash flows among the various contracting parties. Collectively, these parties have incentives to minimize agency costs (Jensen and Meckling 1976). While each party *ex-ante* has an incentive to write contracts that transfer wealth from the other parties, rational self-interest by these other parties limits such wealth transfers. If the contracts use accounting numbers, the manager's choice of methods over the life of the contracts is constrained to the *accepted set* of accounting procedures. Once the contracts are in place, the manager undertakes accounting and other decisions that, combined with random states of nature, produce cash flows that are distributed to the claim holders. Since future circumstances are likely to change and managers have specialized knowledge of which accounting methods would maximize the value of the firm, it may be optimal to allow managers some discretion over future accounting choices (Demski et al. 1984).

When writing the contracts prior to buying the outside claims, the contracting parties realize that the manager's future decisions can transfer wealth among all the contracting parties. Asymmetric information and costly monitoring prevent the contracting parties from perfectly monitoring managers. *Expected managerial opportunism* is the loss in value other contracting parties forecast the managers will cause, given contracting costs. Given the existing contracts, the outside debt- and share-holders discount the price they are willing to pay for their claims for any expected managerial actions that reduce their future returns. The claim holders are price protected against the *expected* amount of opportunism.

Managers' decisions (including choice of accounting methods from within the accepted set) can enhance their own expected welfare at the expense of other claim holders. However, since rational claim holders are price protected against expected opportunism, managers have an incentive to minimize expected opportunism; expected opportunism is efficient.¹ The firm-value-maximizing amount of expected opportunism occurs when the marginal cost of monitoring and contracting equals the marginal reduction in the cost of expected opportunism. The remaining expected opportunism is the Jensen and Meckling (1976) residual loss and is incorporated in the prices contracting parties pay for their claims. *Efficient* managerial actions increase *aggregate* wealth of parties to a contract, including the manager, after all contracting costs.²

Opportunism occurs when a manager's decision increases the manager's wealth, but does not create a net increase in aggregate wealth. Since claim holders are price protected, opportunism is the *excess* opportunism over that expected. The date expectations are formed is important to the definition. Expectations formed at the time contracts are negotiated affect the contracts written, including definition of the accepted set of accounting procedures, and the prices paid for the claims. As new information about firms' circumstances arrives, contracting parties revise both their assessments of the firm-value-maximizing decisions and their expectations of total managerial opportunism, given the existing contracts and enforcement mechanisms. Therefore, opportunism is the difference between the value effect of the decision made by a manager and that expected by shareholders at the time the decision is made. Opportunism occurs if: (1) circumstances change such that some firms' control systems allow managers to enrich themselves more than expected, or (2) mistakes are made in writing the initial contracts.

In the remainder of the paper, *opportunism* means the *unexpected* managerial actions that transfer wealth to managers from the debt- and share-holders, when there is no net increase in

¹ Whether agents or principals, or both, bear agency costs depends on the structure of labor and asset markets. In competitive securities markets, rational principals earn a normal return and the agent bears the agency costs.

² The wealth of some parties may initially decline with a given action, but, as long as aggregate wealth increases, side payments ensure that no party loses and at least one gains.

aggregate wealth. The term *opportunistic managers* refers to managers who take actions to increase their wealth at the expense of debt- and share-holders in excess of those decisions that were expected. The next two sub-sections describe how accounting procedures can either increase firm value (be efficient) or transfer wealth to managers (be opportunistic).

Efficient Accounting Choice

Accounting methods can be efficient (firm value-maximizing) in several ways. First, as discussed above, some expected opportunism is efficient. If the manager selects an accounting method that increases managerial wealth at the expense of other contracting parties who expected this choice, then this accounting method cannot be considered inefficient. Contracting costs ensure it is not optimal to eliminate all potential opportunism.

Second, decision making and internal control mechanisms such as make-versus-buy decisions, cost allocations, transfer pricing, capital budgeting, planning, pricing decisions, and performance evaluation and compensation are affected by accounting method choice. These decision and control mechanisms are inter-related, so value-maximization requires picking accounting methods that jointly optimize these decisions (Ball 1989; Christie et al. 1993). The efficient method varies across industries and through time as circumstances change. Internal and external accounting policies need not be the same, but they often are (Vancil 1978, 360). If accounting methods are chosen to maximize firm value, external reporting partly reflects accounting choices made for value-maximizing internal decision-making and control purposes.

Third, the efficient choice is affected by tax considerations. For example, one aspect of efficient choice of inventory method is minimization of the present value of taxes. Typically, efficiency involves choosing the income-decreasing method, but if a firm has a tax loss carry forward that is about to expire, value-maximization leads to choosing the income-increasing inventory method.

Fourth, Jensen (1988, 24) argues that when industries have excess capacity and slowing growth, exit is often less costly via merger and orderly liquidation than by disorderly, expensive bankruptcy. Firms become takeover targets because of poor operating performance, independent of managers' opportunism. For example, if shifts in the industry supply or demand curves cause an industry to contain too many firms, takeovers eliminate the excess capacity. In the short run, some firms in the industry face financial distress and *ceteris paribus* move closer to the constraints in their debt covenants. Faced with a contracting industry and in financial distress, income-increasing accounting methods increase firm value by reducing recontracting costs with debt-holders. If income-increasing accounting methods minimize the costs of financial distress, then they are not *per se* evidence of managerial opportunism.

Opportunistic Accounting Choice

Self-interested managers seek ways to raise their compensation above the value of their marginal product to the firm. Boards of directors, auditors, stock-based compensation plans, competition in the product markets, competition from other managers and corporate control contests limit the agency costs of self-interested managers. But all these devices are costly and limited in their ability to eliminate managerial self-dealing. We define opportunistic accounting choice as the income-increasing accounting methods in excess of those expected, given the information at the time the accounting choices are made. Opportunistic managers are predicted to pursue income-increasing accounting methods for two reasons: (i) to increase compensation via formal and informal compensation schemes that base executive pay on reported earnings and (ii) to reduce the likelihood senior management is forcibly removed for poor operating performance due to bad decisions.

Holthausen and Leftwich (1983, 84) argue that, with costly contracting, compensation plans create incentives for managers to select non-firm-value-maximizing accounting procedures. Formal bonus plans often create incentives for managers to choose income-increasing accounting methods to inflate earnings (Healy 1985). In firms without formal plans, but where executive pay is based on accounting earnings, managers have incentives to choose income-increasing accounting methods. Considerable evidence exists documenting the positive association between executive pay and accounting earnings after controlling for stock price movements (Antle and Smith 1986; Sloan 1993). Abdel-khalik (1985) and Healy et al. (1987) find that compensation committees do not nullify the effect of accounting changes.³

Managers are replaced either directly by the board firing them or by takeovers that lead to replacing the existing board and senior managers. Weisbach (1988) and Murphy and Zimmerman (1992) report that executive turnover is higher when accounting earnings are lower than last year's earnings after controlling for stock performance.⁴ Weisbach concludes that directors use accounting earnings performance more than stock returns in their decision to replace the CEO. DeAngelo (1988) argues that non-value-maximizing managers choose income-increasing methods more frequently than value-maximizing managers to help defeat proxy contests.

Shleifer and Vishny (1989) argue that managers use a variety of entrenchment schemes, including use of disclosure policies that make it harder for non-managers to estimate the gains from replacing incumbent managers. Accounting procedure choice is one way managers mask non-value-maximizing expenditures from outsiders. Because they do not have access to all the parameters involved in the accounting calculations, it is difficult for outsiders to determine the value-maximizing accounting methods for the firm. If outsiders conclude that managers selected opportunistic accounting choices, it is difficult for them to produce pro-forma statements using alternative accounting methods. For example, while outsiders know that straight-line depreciation is being used, they do not know the assumed asset lives nor the estimated salvage values necessary to convert from straight-line to accelerated depreciation.

Measuring the Relative Importance of Efficiency and Opportunism

To estimate the upper bound on the amount of accounting opportunism in a random sample, we select a non-random sample of firms that ex-post reveal a higher fraction of opportunistic managers. Our non-random sample consists of firms subjected to corporate control actions. Prior to the corporate control actions, managers of these firms are likely to select more opportunistic accounting methods than managers in a random sample of firms. By comparing our estimate of the upper bound on the amount of accounting opportunism with the average choices of surviving firms, we can assess the relative importance of opportunism and efficiency in accounting choice.

After reviewing the evidence, Shleifer and Vishny (1988, 11) conclude, "In sum, internal control devices are not especially effective in forcing managers to abstain from non-value-maximizing conduct. In these circumstances, it is not surprising that external means of coercion such as hostile takeovers can come to play a role."⁵ Our maintained hypothesis is that takeover

³ Healy et al. (1987) explain this finding by the relatively small effect of the accounting change on compensation. They report that the potential effect on executive compensation of switching to straight-line depreciation is 1.5% per year. However, if the accounting change was made for efficiency reasons (e.g., to better approximate opportunity costs for internal decision making), then one would not expect the board to undo the effect of the accounting change on compensation.

⁴ Blackwell et al. (1994) report similar results for lower-level managers of Texas banks.

⁵ See Morck et al. (1988, 1989), Bhidé (1989), Dann and DeAngelo (1988), Ruback (1988), Mitchell and Lehn (1990), and Shivdasani (1992).

targets have a higher incidence of non-value-maximizing managers than non-targets.⁶ We argue that, prior to becoming control targets, these managers are more likely to use income-increasing accounting procedures than managers of their industry peers that never become takeover targets.⁷

Two studies, Groff and Wright (1989) and DeAngelo (1988), are related to our paper. Groff and Wright report that 79 firms receiving tender offers in 1975-79 choose more income-increasing accounting methods than a control sample of industry-size-leverage matched non-takeover targets in the year before the control action. Their study examines only one type of corporate control action (tender offers). Finally, they focus only on the accounting method choices in the year prior to the tender offer, which could be affected by anticipation of the takeover. DeAngelo (1988) finds that incumbent managers exercise their discretion to increase accounting accruals during 86 proxy contests over board of director seats. While she does not examine accounting procedures used prior to the contest, her examination of unexpected earnings and accounting accruals leads her to conclude that, during the contest, incumbent managers exercise their discretion to increase reported earnings (even though cash flows are not higher). The Groff and Wright (1989) and DeAngelo (1988) findings are consistent with incumbent managers acting opportunistically with respect to accounting choices. However, unlike this study, Groff and Wright and DeAngelo do not attempt to determine the relative importance of efficiency and opportunism in their findings.

II. Sample Selection and Measurement of Variables

This section describes the takeover sample, our measure of the benchmark for efficient accounting choice and measurement of variables.

Takeover Sample

Our sample of corporate control targets is drawn from Robert Comment's Mergers and Acquisitions Database. Targets must also have monthly returns available on *CRSP* and financial data on the *Compustat* Annual Industrial, Full Coverage and OTC, or Annual Research files, which encompass both surviving and non-surviving firms.

The 1990 version of the Comment Database contains 4,638 control actions covering all NYSE and AMEX firms through 1989. We focus on the initial control action in selecting our sample of targets. Our analysis is in event time and covers the 12 years from -11 to 0 where year "0" is the year of the public announcement of the first control action for the target in the Comment file. The stock return analysis is based on month zero rather than year zero. We limit the sample period to 1981-1988. *Compustat* first discloses data on three accounting methods (depreciation, inventory, and the investment tax credit) in 1972, so 1981 is the first year with ten years of accounting method disclosures prior to and including the initial control action. We use all data available in each period, so the number of observations changes over time.

Seven types of control actions are selected, yielding a sample of 543 firms with data on the *CRSP* and *Compustat* files. The seven included categories of control actions and their frequencies

⁶ Corporate control actions take several forms, including mergers, tender offers, and proxy contests. Mergers entail a direct negotiation between the bidder and target which is then subject to shareholder approval. In tender offers, bidders offer directly to the shareholders to purchase their stock. With enough shares, the bidder gains control of the board of directors. Proxy contests involve a direct solicitation of the shareholders to elect a dissident slate of directors to the board.

⁷ Opportunistic managers might choose income-deflating methods to increase outsiders' expectations that they are in fact non-opportunistic. If opportunistic managers try to "hide" among non-opportunistic managers in this way, our tests are biased against finding opportunism.

Table 1
Description of Takeover Sample According to Type of First Control Action
1981-1989*

	<i>No. of Firms</i>	<i>%</i>
Merger proposal	222	41%
Targeted repurchase of over 5% of outstanding shares	126	23%
Unnegotiated tender offer to be followed by merger	70	13%
Negotiated tender offer to be followed by merger	68	13%
Proxy fight over board seats	29	5%
Unnegotiated partial tender offer	22	4%
Negotiated partial tender offer (no merger planned)	6	1%
Total number of firms	543	100%

* The sample consists of all firms on the Compustat database in these categories with data on the CRSP and Compustat files. The first control action is defined as the first chronological control action for each firm in the Compustat database.

are listed in table 1. Merger proposals, at 41 percent of the sample, are the largest single category. These are announcements the company has received a proposal that the board has not yet agreed to accept or reject. The next largest category (23 percent of the sample) is targeted share repurchases ("greenmail"). Prior research on greenmail actions finds these transactions further entrench incumbent management (Dann and DeAngelo 1983; Bradley and Wakeman 1983; Klein and Rosenfeld 1988). None of the other types of tender offers and proxy fights in table 1 accounts for more than 13 percent of the sample.

Our sample excludes initial control actions that are friendly deals, to reduce the likelihood of including value-maximizing managers in the takeover sample.⁸ We also exclude cleanup offers by parents, asset sales and voluntary liquidations. Cleanup mergers occur after a takeover for which the date of the earlier partial merger is not on the file. It is unlikely that these excluded actions are aimed at replacing non-value-maximizing managers. While the categories chosen to include or exclude from the takeover sample are somewhat arbitrary, the results are not sensitive to the sample selection criteria as discussed in more detail below.

Benchmarks for Efficient Accounting Choice

Estimating opportunism in accounting choice requires a control for efficient choices, but we do not know which accounting methods maximize firm value. Nor do we know how such efficient choices, including the amount of expected opportunism, vary across industries. Economic Darwinism predicts that the average accounting method of the surviving, non-takeover-target firms in the target's industry reflects the efficient accounting choice. If some of the surviving firms have opportunistic managers who are too entrenched to be removed, surviving firms' accounting choices might also reflect some opportunism. This possibility reduces the power of our tests by reducing differences between our target firms and their surviving industry peers.

⁸ The friendly deals comprise 266 cases where there are merger talks or the company seeks a buyer, and 220 cases where a merger agreement is announced with no prior tender offer.

We construct an "industry index" of accounting choice. All firms in the target's three-digit SIC industry on the Annual Industrial *Compustat* file are included in the index if: (i) the firm's accounting-method choice is disclosed and (ii) the firm is not listed in the Comment file. Our results do not change if two-digit SIC codes are used instead of three-digit codes. Restricting the index to Annual Industrial *Compustat* firms ensures that they are surviving firms. Surviving firms are used because the maintained hypothesis is that these firms are more likely to use efficient accounting methods than non-surviving firms. *Ceteris paribus*, calculating an industry index increases the power of the tests over choosing a single control firm in the target's industry by reducing the sampling variation in the benchmark portfolio.

Measurement of Accounting Variables

An income-increasing accounting method either defers an expense to a later period or recognizes revenue earlier rather than later in time. For the three accounting methods studied (depreciation, inventory, and ITC), each target and surviving firm's accounting-method choice in year t is coded "1" if the income-increasing method is selected (straight-line depreciation, FIFO, and flow through for ITC) or "0" if the income-decreasing method is chosen (accelerated depreciation, LIFO, and deferral for ITC).⁹ The "industry index" accounting method is the percentage of the surviving non-target firms in the target firm's industry using the income-increasing accounting method (e.g., straight-line depreciation).

III. Descriptive Statistics

Sample Composition

The frequency of calendar years of initial takeover bids (year 0 in event time) is almost uniformly distributed over the nine year sample period with 1986 exhibiting the largest concentration of the observations (16 percent). The one-digit SIC composition of the takeover sample resembles the industry composition of the population of *CRSP-Compustat* firms.

Effects of Accounting Choices on Retained Earnings

Critical assumptions underlying our tests are that straight-line depreciation, FIFO, and flow through for the ITC are income-increasing and have an economically important effect. Sweeney (1994) finds that one of the first debt constraints violated by firms that default on bond covenants is the equity constraint. Therefore, we estimate the retained earnings of target firms as if they use the alternative method. Retained earnings for the median target firm using straight-line depreciation would be about 26 percent lower if it used sum-of-years-digits depreciation.¹⁰ Retained earnings for the median target firm using LIFO would be about 9 percent higher if it used FIFO.¹¹ If target firms using deferral for the ITC had been using flow through, the median retained

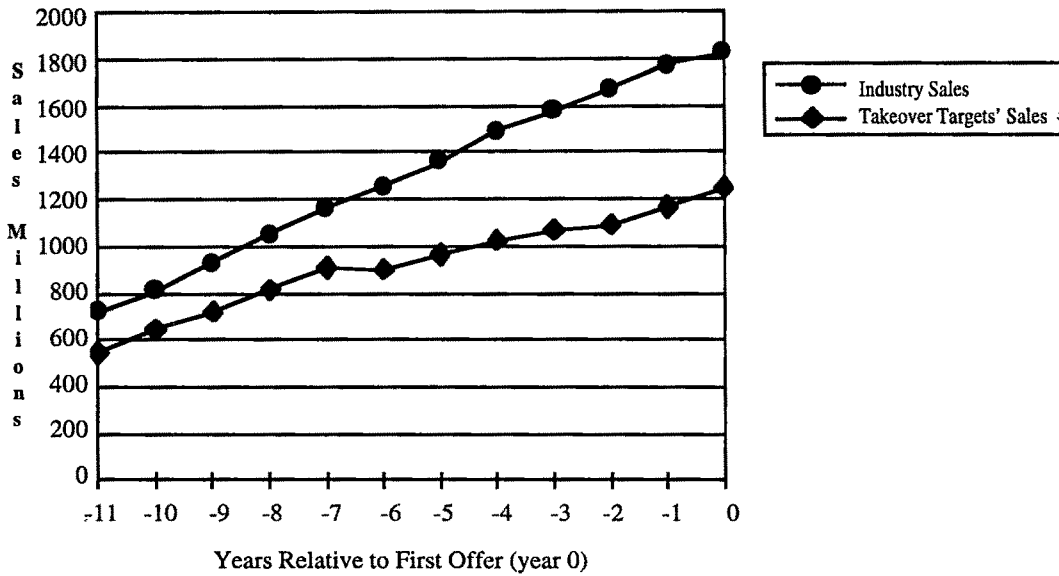
⁹ While labeling LIFO as income-decreasing misclassifies those firms in declining-cost industries, there are only three firm-year observations with negative LIFO reserves out of more than 16 thousand observations. Also, our conclusions are not sensitive to alternative ways of classifying inventory methods as income-increasing or decreasing based on the average method used in the industry.

¹⁰ Minus 26% is the ratio of the cumulative after-tax change in depreciation from straight-line to sum-of-years-digits divided by retained earnings. The change in depreciation is calculated using the firm's estimated asset life (historical cost of the assets divided by depreciation expense) and average age of the assets (accumulated depreciation divided by depreciation expense).

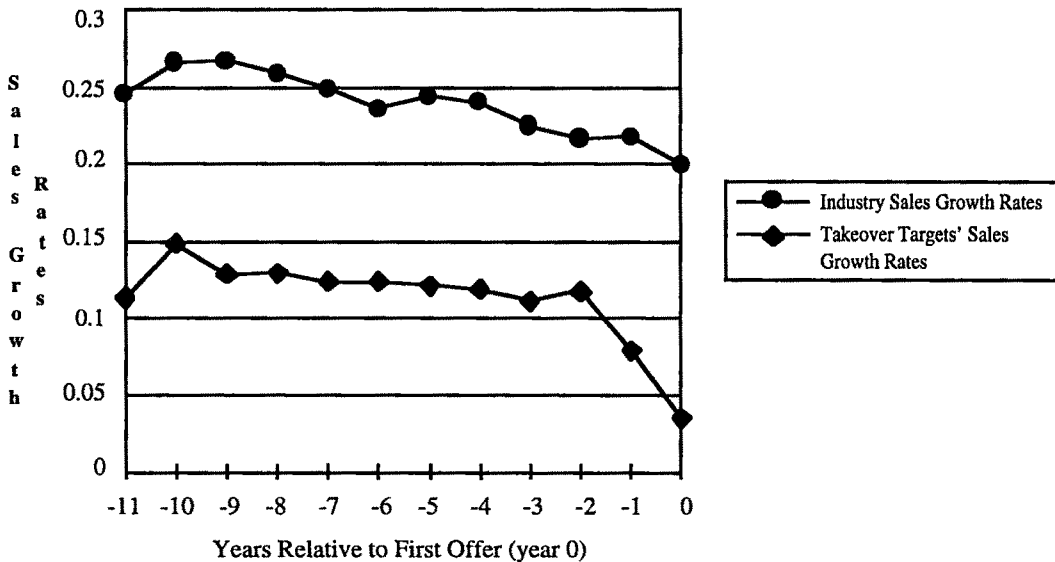
¹¹ For each target on LIFO, we calculate the ratio of the after-tax LIFO reserve to retained earnings.

Figure 1
Sales and Growth Rates of Takeover Targets and their Industries

Panel A Sales: Takeover Targets versus Industry Mean

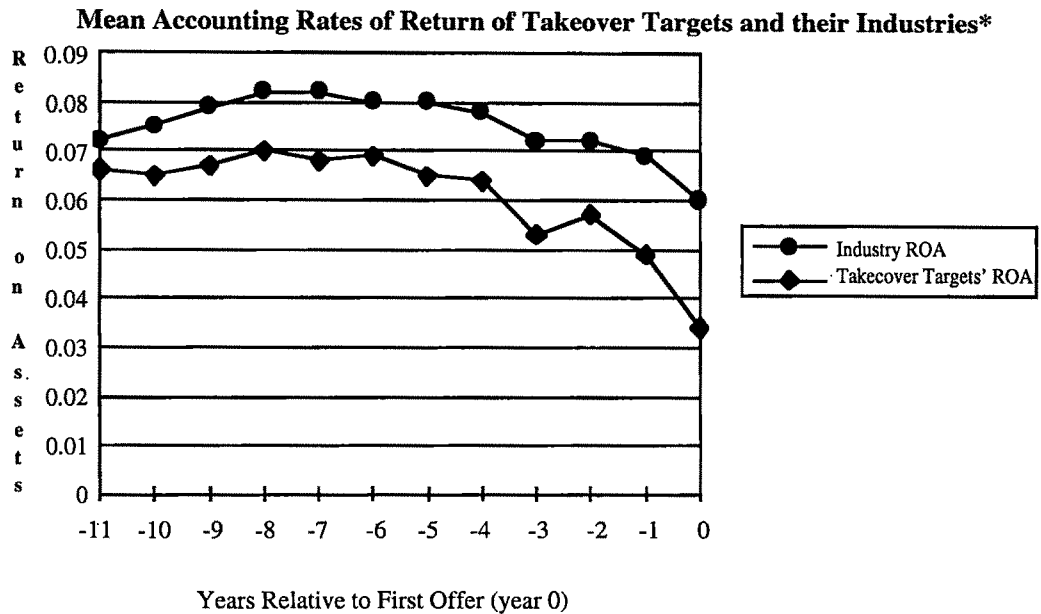


Panel B Sales Growth Rates: Takeover Targets versus Industry Mean*



*Sales growth rates are calculated as sales in year t divided by sales in year $t-1$ less one for each target and industry firm. The industry firms' growth rates are averaged. Then, the cross-sectional averages in growth rates in sales for takeover targets and their industries are calculated.

Figure 2



* Accounting rates of return are calculated as net income before interest divided by total assets. Net income before interest is computed by adding after-tax interest to net income using the highest marginal Federal corporate tax rate in that calendar year.

earnings would be about 5 percent higher.¹² These medians are significantly different from zero at the 0.01 level and are fairly constant over the event years -11 to -1.

Firm-Performance Measures

Takeover targets are predicted to have worse performance than their industry peers for two reasons. First, opportunistic managers invest sometimes in unprofitable projects to further entrench themselves at shareholder's expense (Shleifer and Vishny 1989) or consume higher levels of perquisites than their industry peers. Second, exogenous industry-wide contraction causes the worst performing firms to become takeover targets (Jensen 1988). Accounting data and abnormal stock returns are presented that are consistent with both these possibilities.

Accounting Performance Measures. Targets are smaller than their industry cohorts. Figure 1 panel A is the time series of mean sales for the takeover targets and their corresponding industry mean sales. In all 12 years, targets have statistically significantly smaller mean sales than their three-digit SIC industry peers. In years -6 to 0, the size differences become more pronounced. While we report year zero for descriptive reasons, the results in year zero should be interpreted cautiously for two reasons. First, the number of observations declines from 524 firms in year -1 to 355 firms in year zero as targets are acquired. Second, even when we have data for year zero, we have no way of determining whether they reflect the decisions of new management. The t -

¹²For targets on deferral, the balance sheet deferred ITC is divided by retained earnings.

Table 2
Mean Monthly Abnormal Stock Returns Preceding Takeover Bid

<i>Estimation Months [#]</i>	<i>Takeover Targets</i>	<i>Industry Indices</i>	<i>Differences between Target Firms and their Industries</i>	<i>Number of Paired Differences</i>
-185,-150	-0.0056*	-0.0012*	-0.0052*	305
-149,-114	-0.0050*	-0.0013*	-0.0037*	360
-113,-78	-0.0074*	-0.0023*	-0.0048*	385
-77,-42	-0.0073*	-0.0005	-0.0064*	429
-41,-6	-0.0071*	-0.0004	-0.0070*	494

[#] Estimation months are relative to month 0, the month of the first control action. Each of the five periods comprises 36 months.

* Statistically different from zero at the 0.05 level or greater (one-tail test).

statistics on the difference in mean sales (not reported) range from -2.26 (in year -7) to -4.44 (in year -2). The results for total assets are qualitatively the same as sales.

Figure 1 panel B plots the mean annual sales growth rates of the targets and their industry indices. For both targets and their industry peers, growth rates are generally declining prior to the control action. In all 12 years the targets have smaller sales growth rates than surviving non-target firms in the same industry. All 12 of the differences are reliably different from zero at the 0.05 level with *t*-statistics (not reported) ranging from -5.05 (in year -1) to -9.23 (in year -9).

Figure 2 plots the accounting rates of return (ROAs) of the targets and their industry counterparts.¹³ Takeover target ROAs are smaller than their industry peers. In year -7 the mean difference in ROA between the targets and their industries is -1.2% (not reported). The mean ROA difference increases to -1.9% by year -1. In all years -10 to 0, the difference between target and industry ROAs is reliably different from zero at the 0.05 level (one-tail test) with *t*-statistics ranging from -2.06 (in year -10) to -4.75 (in year -1). Figures 1 and 2 are consistent with our maintained hypothesis that takeover targets perform worse than surviving firms in their industries as documented in other studies (e.g., Bhidé 1989).

Abnormal Stock Returns. Abnormal stock market performance is estimated using Jensen (1968) alphas for five non-overlapping three-year periods ending six months before the first control action. We use a monthly equally-weighted market index comprising all surviving, non-

¹³ ROA is calculated as net income before interest divided by total assets. Net income before interest is computed by adding after-tax interest to net income using the highest marginal Federal corporate tax rate in that calendar year.

target firms on the *CRSP* file. We also examine industry abnormal performance by applying the same procedure to the portfolio of surviving firms in each target's three-digit SIC industry.

Table 2 presents the cross-sectional means of the estimated abnormal returns for the targets and their industries. In each of the five non-overlapping three year periods, the mean abnormal return of the target firms is reliably less than zero at the 0.05 level. The targets' mean estimated abnormal return is about -8.5% per year (-.0071 per month) over the months -41 to -6 preceding the first control action. The negative performance persists back 15 years and is present to a lesser extent in the industry index as well.

Table 2 also reports that, relative to the surviving firms in their industries on *CRSP*, takeover targets exhibit statistically significant negative abnormal stock returns in the 15 years preceding the first control action. These negative abnormal returns for the targets and (to a lesser extent) their industry cohorts are consistent with the findings for sales growth rates and ROAs in figures 1 and 2. These findings are similar to Palepu's (1986) results and are consistent with poorly performing firms and those in declining industries subsequently becoming takeover targets. In the next section, we find persistence in the accounting method choices. The target firms have been using more income-increasing accounting methods than their industry peers for up to 11 years prior to the control contest.

IV. Empirical Tests

This section presents multivariate tests of the efficient and opportunistic accounting-choice hypotheses. The evidence indicates that efficiency is more likely than opportunism to explain the accounting choices of a random sample of firms. These findings are robust to alternative sample selection criteria and model specifications.

Multivariate Tests of Efficient and Opportunistic Choice Hypotheses

Measuring opportunism requires an estimate of the efficient choice at the time of the manager's decision. We estimate annual models to allow for the arrival of new information that changes the firm-value-maximizing accounting choice, including the expected opportunism. Therefore, estimation of opportunism requires separate cross-sectional regressions for each accounting procedure annually for years -11 to -1. The controls for efficient choices include the average choice of surviving firms, the existence of tax losses and measures of operating performance.¹⁴

Under the efficiency hypothesis described above, value-maximizing managers choose income-increasing accounting methods to reduce the costs of financial distress (e.g., debt covenant violation and bankruptcy). We predict also that tax loss carry forwards provide an incentive to choose an income-increasing inventory method. Thus, for efficiency reasons, takeover targets, which are more likely to be in financial distress and have tax loss carry forwards, choose income-increasing methods.¹⁵

For each of the three accounting methods studied (depreciation, inventory, and investment tax credit), the firm's accounting-method choice in year *t* is coded "1" if the income-increasing

¹⁴ A *changes* approach (time differencing) provides estimates of changes in opportunism, not the estimates of the *level* of opportunism we require. Also, the annual cross-sectional models reported trace out the time-series behavior of differences between targets and their industry peers.

¹⁵ Accumulated tax losses and financial distress are related, but the tax losses affect only the inventory method choice, not depreciation or ITC.

method is selected or “0” if the income-decreasing method is chosen.¹⁶ The annual industry index is the percentage of surviving non-target firms in the industry using the income-increasing method in the same calendar year as the target. This industry index is assumed to capture efficient choices, including expected opportunism. The index is subtracted from the target’s choice (i.e., zero/one) in each year in event time. Year 0 is the year of the first control action. Similarly, each explanatory variable is differenced from its corresponding industry mean.

The estimated cross-sectional regressions are

$$M_{it}^j = a_{0t}^j + a_{1t}^j D_i + a_{2t}^j \text{CARRY}_{it} + a_{3t}^j \text{COVER}_{it} + a_{4t}^j \text{RET}_{it} + a_{5t}^j \text{RISK}_{it} + a_{6t}^j \text{LEV}_{it} + a_{7t}^j \text{SIZE}_{it}, (1)$$

where

$$t = -11, -10, \dots, -1,$$

$$j = 1 \text{ (depreciation choice), } 2 \text{ (inventory choice), } 3 \text{ (ITC choice),}$$

$$M_{it}^j = j^{\text{th}} \text{ accounting-method choice by firm } i \text{ (1 = income-increasing, 0 otherwise) less the industry average of the } j^{\text{th}} \text{ accounting method choice,}$$

$$D_i = 1 \text{ if the } i^{\text{th}} \text{ firm is a corporate control target, 0 otherwise,}$$

$$\text{CARRY}_{it} = 1 \text{ if tax-loss carry forward, 0 otherwise less industry mean CARRY,}$$

$$\text{COVER}_{it} = (\text{Net income} + \text{after-tax interest})/(\text{interest}) \text{ less industry mean COVER,}$$

$$\text{RET}_{it} = \text{Firm } i\text{'s stock return less industry mean RET,}^{17}$$

$$\text{RISK}_{it} = \text{Standard deviation of firm } i\text{'s stock return less industry mean RISK,}^{18}$$

$$\text{LEV}_{it} = (\text{Book value of debt/book value of total assets}) \text{ less industry mean LEV,}$$

$$\text{SIZE}_{it} = \log(\text{sales}) \text{ less } \log(\text{industry mean sales}).$$

A dummy variable, D , is included in equation (1) to capture the difference in accounting choice for takeover targets. To use this dummy, the regressions are estimated using the takeover targets and two industry and size matched non-targets for each target. Two non-target firms with sales just less than the target and just more than the target in the same industry, but which never were targets, are selected if they have data on the *CRSP* and the annual industrial *Compustat* files. The matching is based on sales in the year prior to the initial control action. The two industry-size matched firms are assigned the target’s first takeover bid date as year zero.

Under our maintained hypotheses, the regressions estimate the upper bound on accounting opportunism. Opportunism cannot exist when both targets and their industry peers are all using the income-increasing method; all these firms are making efficient choices. To increase the power to detect opportunism, observations are deleted if the target and all the firms in its industry use the income-increasing accounting method. Significance levels are slightly lower when the observations where opportunism cannot exist are included, but none of the paper’s inferences change.

¹⁶ Specifically, *Compustat* footnote item 15 is used to classify depreciation method choice. Firms using both straight-line and accelerated are coded 0.5. Footnote item 8 is used to classify ITC choice. If the first significant digit of data item 59 is LIFO, the firm is classified as a LIFO firm; otherwise it is classified as a FIFO firm.

¹⁷ RET_{it} is the continuously compounded 36 month raw stock return for firm i ending in the last month of calendar year t . The corresponding industry return is the continuously compounded return on the industry portfolio over 36 months ending in the same calendar month as the target’s return. Because of the forward-looking nature of stock prices and because we do not know when the market first starts to anticipate adverse firm performance, we choose a long window (36 months) to capture changes in the market’s expectations of performance.

¹⁸ RISK_{it} is the standard deviation of the 12 monthly raw stock returns for firm i in calendar year t .

Table 3
Cross-Sectional Regressions of Depreciation Choice

$$M_{it}^j = a_{0t}^j + a_{1t}^j D_t + a_{2t}^j CARRY_{it} + a_{3t}^j COVER_{it} + a_{4t}^j RET_{it} + a_{5t}^j RISK_{it} + a_{6t}^j LEV_{it} + a_{7t}^j SIZE_{it}$$

<i>Predicted sign</i>	CONST.	D	CARRY	COVER	RET	RISK	LEV	SIZE	R ²	N	<i>Industry Mean</i>
<i>Year</i>	?	+	?	-	-	+	+	-			
					<i>Annual Regressions Coefficients & t-statistics</i>						
-11	-0.013 (-0.66)	0.027 (1.01)	-0.071 (-1.73)	0.000 (0.75)	0.001 (0.06)	0.058 (0.22)	0.524 (5.36)	-0.015 (-1.83)	.05	569	0.770
-10	-0.022 (-1.23)	0.036 (1.45)	0.001 (0.14)	0.000 (0.07)	-0.014 (-0.75)	-0.064 (-0.24)	0.416 (4.54)	-0.017 (-2.31)	.04	633	0.774
-9	-0.010 (-0.58)	0.035 (1.52)	-0.000 (-0.03)	-0.000 (-0.44)	0.009 (0.51)	0.444 (1.78)	0.372 (4.68)	-0.015 (-2.11)	.04	779	0.769
-8	-0.021 (-1.33)	0.026 (1.25)	0.012 (0.36)	-0.001 (-1.29)	0.017 (0.99)	-0.126 (-0.55)	0.441 (5.59)	-0.023 (-3.54)	.06	850	0.776
-7	-0.012 (-0.77)	0.034 (1.62)	0.026 (0.77)	-0.000 (-1.32)	0.035 (1.96)	0.067 (0.29)	0.355 (4.70)	-0.022 (-3.49)	.05	868	0.777
-6	-0.022 (-1.22)	0.035 (1.72)	0.011 (0.32)	-0.000 (-0.13)	-0.012 (-0.55)	-0.003 (-0.02)	0.297 (4.10)	-0.022 (-3.49)	.04	905	0.776
-5	-0.023 (-1.07)	0.039 (1.98)	-0.014 (-0.45)	0.000 (0.82)	-0.021 (-0.78)	0.248 (1.01)	0.227 (3.41)	-0.015 (-2.54)	.02	926	0.781
-4	-0.001 (-0.28)	0.042 (2.20)	-0.020 (-0.69)	0.000 (0.20)	0.009 (0.38)	0.077 (0.39)	0.290 (4.44)	-0.016 (-2.83)	.03	957	0.785

(Continued)

Table 3 (Continued)

Years	Mean Coefficients & Z statistics*									
-3	-0.011 (-0.58)	0.039 (2.07)	0.002 (0.06)	0.000 (0.10)	0.008 (0.33)	-0.130 (-0.67)	0.110 (2.30)	-0.017 (-2.96)	.01	992 0.788
-2	0.002 (0.09)	0.040 (2.18)	-0.016 (-0.60)	0.000 (0.53)	0.021 (0.91)	0.032 (0.19)	0.299 (5.04)	-0.015 (-2.77)	.03	1001 0.791
-1	0.013 (0.83)	0.030 (1.67)	-0.018 (-0.70)	0.000 (0.44)	0.046 (2.10)	0.218 (1.50)	0.214 (3.86)	-0.012 (-2.31)	.02	1017 0.799
-11 to -7	-0.016 (-1.28)	0.032 (1.65)	-0.006 (-0.18)	-0.000 (-0.96)	0.010 (1.33)	0.076 (1.35)	0.421 (8.28)	-0.018 (-4.27)	.05	5 0.773
-6 to -1	-0.008 (-0.57)	0.038 (2.59)	-0.009 (-0.68)	0.000 (0.78)	0.009 (1.04)	0.074 (1.97)	0.239 (7.04)	-0.016 (-4.97)	.03	6 0.787

* Z statistic adjusted for time-series dependence in the t-statistics from the annual cross-sectional regressions using an AR(2) process.

M_{it}^j = j^{th} accounting-method choice by firm i (1 = income-increasing, 0 otherwise) less the industry average of the j^{th} accounting method choice,
 D_i = 1 if the i^{th} firm is a corporate control target, 0 otherwise,
 $CARRY_{it}$ = 1 if tax-loss carry forward, 0 otherwise less industry mean $CARRY$,
 $COVER_{it}$ = (Net income + after-tax interest)/(interest) less industry mean $COVER$,
 RET_{it} = Firm i 's stock return less industry mean RET ,
 $RISK_{it}$ = Standard deviation of firm i 's stock return less industry mean $RISK$,
 LEV_{it} = (Book value of debt/book value of total assets) less industry mean LEV ,
 $SIZE_{it}$ = log(sales) less log(industry mean sales).

Table 4
Cross-Sectional Regressions of Inventory Choice[†]

$$M_{it}^j = a_{0t}^j + a_{1t}^j D_i + a_{2t}^j CARRY_{it} + a_{3t}^j COVER_{it} + a_{4t}^j RET_{it} + a_{5t}^j RISK_{it} + a_{6t}^j LEV_{it} + a_{7t}^j SIZE_{it}$$

Predicted sign	CONST.	D	CARRY	COVER	RET	RISK	LEV	SIZE	R ²	N	Industry Mean
Year	?	+	+	-	-	+	+	-			
Annual Regressions Coefficients & t-statistics											
-11	-0.060 (-2.07)	0.077 (1.92)	0.176 (2.52)	-0.001 (-1.04)	0.031 (0.85)	0.713 (1.65)	0.262 (1.69)	-0.038 (-3.05)	.06	498	0.804
-10	-0.083 (-2.90)	0.027 (0.67)	0.161 (2.36)	-0.000 (-0.71)	-0.067 (-1.96)	0.258 (0.60)	0.434 (2.75)	-0.055 (-4.51)	.07	554	0.773
-9	-0.060 (-2.05)	0.021 (0.54)	0.086 (1.34)	0.000 (0.07)	-0.044 (-1.39)	0.970 (2.15)	0.422 (2.86)	-0.046 (-3.86)	.06	608	0.745
-8	-0.068 (-2.45)	0.040 (1.08)	0.131 (2.17)	0.001 (1.37)	-0.048 (-1.55)	0.714 (1.74)	0.459 (3.15)	-0.048 (-4.22)	.06	692	0.713
-7	-0.20 (-0.72)	0.021 (0.59)	0.094 (1.69)	0.001 (1.35)	-0.016 (-0.49)	0.526 (1.29)	0.573 (4.22)	-0.038 (-3.54)	.05	745	0.668
-6	-0.031 (-0.94)	0.044 (1.24)	0.119 (2.05)	0.000 (0.46)	-0.007 (-0.16)	0.907 (2.23)	0.207 (1.54)	-0.036 (-3.28)	.04	765	0.656
-5	-0.046 (-1.18)	0.033 (0.97)	0.092 (1.72)	0.000 (0.31)	0.009 (0.19)	0.806 (1.82)	0.234 (1.87)	-0.046 (-4.42)	.04	796	0.646

Table 4 (Continued)

Mean Coefficients & Z statistics*											
Years											
-4	-0.051 (-1.42)	0.064 (1.96)	0.139 (2.79)	-0.000 (-0.45)	0.018 (0.39)	0.392 (1.10)	0.193 (1.61)	-0.045 (-4.61)	.05	839	0.624
-3	-0.079 (-2.35)	0.078 (2.40)	0.064 (1.29)	-0.001 (-1.15)	-0.012 (-0.27)	0.483 (1.35)	0.282 (2.43)	-0.045 (-4.58)	.05	874	0.614
-2	-0.075 (-2.36)	0.024 (0.75)	0.065 (1.35)	-0.000 (-0.14)	-0.009 (-0.21)	0.507 (1.66)	0.334 (2.94)	-0.056 (-5.74)	.06	879	0.617
-1	-0.082 (-2.64)	0.030 (0.93)	0.101 (2.18)	0.000 (0.67)	-0.013 (-0.29)	0.544 (1.89)	0.244 (2.25)	-0.054 (-5.75)	.06	886	0.620
-11 to -7	-0.058 (-2.78)	0.037 (2.11)	0.130 (7.07)	0.000 (0.52)	-0.029 (-1.45)	0.637 (6.20)	0.434 (5.90)	-0.045 (-5.45)	.06	5	0.741
-6 to -1	-0.061 (-2.71)	0.046 (3.32)	0.097 (7.28)	-0.000 (-0.13)	-0.002 (-0.10)	0.607 (7.66)	0.249 (4.64)	-0.047 (-7.37)	.05	6	0.630

See legend to table 3 for definitions of variables.

*Z statistic adjusted for time-series dependence in the t-statistics from the annual cross-sectional regressions using an AR(2) process.

Surviving non-target firms in the industry are assumed on average to use accounting methods that maximize firm-value. Efficient accounting choices are predicted to vary systematically with tax losses (CARRY) and, through bond covenants, with variables related to performance. We include one variable (COVER) that measures current performance and four variables (RET, RISK, LEV and SIZE) that measure past or cumulative firm performance (Christie 1990; Holthausen and Leftwich 1983; Watts and Zimmerman 1986). Firms with tax-loss carry forwards (CARRY) are more likely to choose FIFO if product costs are increasing. Firms with more variable cash flows and earnings (RISK) are more likely to have been in financial distress earlier and switched to an income-increasing method (Sweeney 1994). *Ceteris paribus*, poorly performing firms will have lower income to interest exposure (COVER), lower stock returns in the preceding three years (RET) and higher leverage (LEV). These firms are more likely to use income-increasing accounting methods. Also, firm size will vary with performance. *Ceteris paribus*, larger firms will tend to be better performers than smaller firms; to become large they were above average performers earlier. Thus, it is less likely these firms switched to an income-increasing method earlier. An alternative explanation for the predicted negative sign on SIZE is larger firms are subjected to greater political scrutiny and are more likely to choose income-decreasing accounting methods (Watts and Zimmerman 1986).

Tables 3, 4 and 5 report the regression results of the three accounting methods. The row labeled "Predicted Sign" contains the predictions of the opportunistic hypothesis for the dummy variable, D, and the efficiency hypothesis for the remaining variables. The next 11 rows in each table report annual cross-sectional regressions for years -11 to -1.¹⁹ To help interpret the regression results, the right-most column reports the proportion of non-target firms in the target's industry using the income-increasing accounting method.

The last two rows in each table labeled Mean Coefficient & Z statistic contain the mean coefficient and asymptotic normal test statistics from the five annual regressions (-11 to -7) and the six annual regressions (-6 to -1). We refer to these two groups of years as the earlier and later periods. The Z statistics are computed as the mean of the individual *t*-statistics divided by a standard error that is adjusted for autocorrelation in the annual *t*-statistics (Christie 1990). The *t*-statistics estimated in the annual cross-sections are not independent over time because of time-series dependence in accounting choices. To adjust for the dependence in the annual *t*-statistics, we make an AR(2) correction for autocorrelation. The AR(2) correction is selected as the best representation of the underlying time-series process for the *t*-statistics after examining correlograms. Given the AR(2) assumption about time-series dependence, each aggregate test statistic is an asymptotically normally distributed Z statistic.²⁰

Depreciation Method Choice. Table 3 reports the results for the depreciation regressions. In the last two rows, the mean coefficient on the takeover dummy variable over the first five years is 0.032 and over years -6 to -1 it is 0.038. The average coefficient in the last six years is about 20 percent higher than in the earlier period; the *t* statistic on this difference is 3.2. The average coefficient is significant at about the 0.05 level (one-tail test) in the earlier period and about the 0.0025 level in the later period. The 11 annual coefficients on the takeover dummy variable, D, are all positive, but only those in years -6 to -1 are statistically different from zero at the 0.05 level

¹⁹ It is possible that the regression residuals are correlated across accounting methods in a given year. However, since the explanatory variables are identical across accounting methods, seemingly unrelated regression collapses to applying ordinary least squares to each equation; see Theil (1971 ch. 7).

²⁰ We are using asymptotic theory with either five or six observations. However, each of the *t*-statistics being aggregated has large degrees of freedom and hence is approximately normally distributed. For practical purposes we are aggregating dependent normal variates.

(one-tail test). The target firms choose straight-line depreciation more frequently than their industry peers and there is a tendency for this frequency to increase through time.

To put the foregoing results in perspective, only three to four out of 100 takeover targets select an income-increasing depreciation method more frequently than their industry peers, after controlling for differences in firm performance, capital structure, and size. The last column indicates that about 78 percent of the targets' industry peers choose straight-line depreciation. The propensity of targets to choose straight-line only 3.8% more of the time is small relative to the average probability of a firm choosing straight-line of 78 percent. Under our maintained hypothesis, the industry index and changes in the industry index reflect efficient choices. This suggests that although accounting opportunism appears to be present in the target sample, it is a second order effect in explaining depreciation method choice. This statement is conditional on the assumption that the mean accounting choice for the industry peer group is determined efficiently.

The variables, CARRY, COVER, RET and RISK, individually have little incremental explanatory power beyond the other variables in the depreciation model and often alternate signs across years. Under the efficiency hypothesis, the coefficient on RET is predicted to be negative; lower stock returns indicate greater financial distress and thus a greater likelihood of income-increasing accounting methods. Inconsistent with the efficiency hypothesis, RET tends to have a positive coefficient. RISK has the predicted positive sign; it is significant at the 0.01 level over the later period. Leverage (LEV) and SIZE have the signs predicted by the efficiency hypothesis and are statistically significant at least at the 0.01 level both in aggregate and in individual years.

Inventory Method Choice. Table 4 reports the regressions for the inventory models. The Z statistics in the last two rows on the takeover dummy variable from aggregating the five and six annual *t*-statistics are both statistically significantly positive (2.11 and 3.32). Even though the takeover dummy variable is significant only in three of the 11 cross-sectional regressions (years -11, -4 and -3), the aggregate test statistics on the dummy variable allow us to reject the null hypothesis of no opportunism by target managers, after accounting for the time-series dependence in the annual *t*-statistics. The mean coefficients on the takeover dummies are of similar magnitude to those reported for the depreciation regressions in table 3.

As in the depreciation case, the average coefficient on the takeover dummy increases from the earlier to later period; the increase is about 25 percent with a *t* statistic of 1.2. The last column in table 4, reports that the targets' peers have decreased their use of FIFO from 80.4% in year -11 to 62.0% in year -1. While target firms have a greater propensity to choose FIFO than their industry peers after controlling for differences in firm performance, capital structure, and size, the magnitude of 4 percent is small relative to the industry mean of about 65 percent.

Tax-loss carry forward (CARRY) has the predicted sign (+) and is statistically significant at the 0.05 level (one-tail test) in eight of the 11 years. The aggregate Z statistics for both the earlier (7.07) and the later (7.28) periods reject the null hypothesis of no association at the 0.001 level. RISK, LEV, and SIZE have the predicted signs and are statistically significant at the aggregate level. As in the depreciation model, the COVER and RET coefficients are insignificant.

ITC Method Choice. The takeover dummy variable for the ITC choice in table 5 is positive, but not statistically significant, in all of the annual regressions. The magnitude of the coefficients on the takeover dummy is similar to those for depreciation and inventory. Targets choose the ITC income-increasing method (flow through) 3 percent more often than their peers, whereas they choose straight-line or FIFO about 4 percent more frequently.²¹ Using the AR(2) adjusted Z

²¹ The ITC was eliminated in 1986. Since only firms using deferral remain in our samples after 1986, the number of observations in the regressions fall in years -4 to -1.

Table 5
Cross-Sectional Regressions of ITC Choice[†]

$$M_{it}^j = a_{0t}^j + a_{1t}^j D_i + a_{2t}^j CARRY_{it} + a_{3t}^j COVER_{it} + a_{4t}^j RET_{it} + a_{5t}^j RISK_{it} + a_{6t}^j LEV_{it} + a_{7t}^j SIZE_{it}$$

	CONST.	D	CARRY	COVER	RET	RISK	LEV	SIZE	R ²	N	Industry Mean
Predicted sign	?	+	?	-	-	+	+	-			
Year					Annual Regressions Coefficients & t-statistics						
-11	-0.066 (-1.62)	0.020 (0.39)	-0.010 (-0.13)	-0.001 (-1.43)	0.057 (1.26)	-0.109 (-0.21)	0.160 (0.88)	-0.044 (-2.79)	.02	323	0.858
-10	-0.085 (-2.31)	0.020 (0.41)	0.011 (0.15)	-0.002 (-2.55)	-0.012 (-0.30)	0.392 (0.74)	0.067 (0.39)	-0.048 (-3.21)	.04	353	0.868
-9	-0.103 (-2.90)	0.036 (0.83)	0.048 (0.69)	-0.000 (-0.88)	-0.088 (-2.34)	0.717 (1.47)	0.150 (1.00)	-0.044 (-3.24)	.05	418	0.877
-8	-0.083 (-2.34)	0.006 (0.15)	-0.003 (-0.04)	-0.001 (-1.15)	-0.060 (-1.62)	1.218 (2.66)	0.231 (1.45)	-0.043 (-3.22)	.06	443	0.887
-7	-0.063 (-1.75)	0.026 (0.61)	0.058 (0.83)	-0.001 (-0.60)	-0.017 (-0.45)	0.521 (1.03)	0.325 (2.07)	-0.042 (-3.29)	.04	447	0.890
-6	-0.038 (-0.97)	0.019 (0.48)	0.008 (0.12)	-0.001 (-1.35)	0.019 (0.40)	1.484 (3.25)	0.205 (1.42)	-0.032 (-2.55)	.05	458	0.895
-5	-0.028 (-0.58)	0.038 (0.96)	0.111 (1.76)	-0.001 (-0.69)	0.031 (0.54)	0.533 (1.04)	0.228 (1.63)	-0.035 (-3.01)	.04	466	0.899

(Continued)

statistics, the probability of observing the aggregate test statistics is about 0.08 in the earlier period and 0.015 in the later period. As with the other methods, the frequency of use of the income-increasing method (flow through) increases about 45 percent from the earlier to later period; the *t* statistic on this difference is 2.6.

RISK, LEV and SIZE again have statistically significant coefficients with the predicted signs. From the last column of table 5, there is a long-term trend from deferral to flow through for the targets' industry peers with 92.4% of the industry peers using flow through by year -1.

Other results to note from tables 3, 4 and 5 are:

1. The size variable is always negative and significant. Notwithstanding the non-target firms included in the regression are matched to the targets on the basis of size, there is still variation in size between the target sample firms and their matched counterparts.
2. The total amount of variation explained by the model (R^2) is generally small, never exceeding 7 percent. This is in part because all the variables are differenced from their corresponding industry means.
3. The tax loss carry forward variable, CARRY, is statistically significant only in the inventory model. We include it in the other models as another proxy variable for firm performance. The fact that CARRY is only significant in the inventory model adds credence to taxes being important only in the inventory accounting choice and suggests that other variables are capturing firm performance in the depreciation and ITC models. These findings are consistent with those reported by El-Gazzar et al. (1986).

The data also reflect a trend towards straight-line depreciation, LIFO and flow through for ITC for the surviving non-target firms. Given our maintained hypothesis that surviving industry peers make efficient accounting choices, these trends are due to changes in efficient choices.

Model Specification. There are two model specification issues. The first is endogeneity. Since some of the explanatory variables in these regressions (e.g., COVER and LEV) depend on the choice of accounting method (the dependent variable), there are endogenous variables on the right hand side of equation (1). Therefore, the regressions are misspecified.

The second specification issue stems from the selection bias we deliberately induce by our sampling procedure. One can think of an indicator function with variables causing some firms to be taken over, and another function determining choice of accounting procedure. Failure to account for the relation between the indicator function and the accounting choice function can lead to inconsistent estimators; see Maddala (1991) for a survey. The theory is not rich enough to allow us to distinguish variables causing takeovers from variables affecting accounting choice. To the extent that poor performance affects both the probability of a takeover and the choice of accounting method, some of the explanatory variables are the same in the two cases. In the absence of a richer theory, we estimate what amounts to a reduced form, conduct specification tests, and investigate the sensitivity of our results to different sample selection methods and alternative explanatory variables.

The White (1980) specification test is a joint test of specification and heteroscedasticity. Since unreported tests using weighted least squares produce similar White statistics to those we report below, we treat significant White statistics as evidence of misspecification, not heteroscedasticity. The White test rejects the null hypothesis that the depreciation regressions are well specified (at the 5 percent level) in two of the 11 years. The situation is worse for the

inventory and ITC regressions for which the White statistic rejects in eight and 11 of the 11 years. The White statistics from (unreported) regressions where the variables are not differenced from their industry means are three to ten times those we find here. That is, the ‘levels’ regressions that appear in Hagerman and Zmijewski (1979) and Skinner (1993) are probably badly misspecified. Differencing all the variables from the industry means dramatically improves, but obviously does not solve, the specification question.

Sensitivity Analysis

The findings reported above are insensitive both to additional restrictions on the sample selection and to alternative model specifications. We construct a “non-synergistic” takeover portfolio where the control action is not undertaken to capture synergies between the bidder and target. The non-synergistic portfolio contains only initial control actions of the following types: unnegotiated tender offer to be followed by merger; unnegotiated partial tender offer; proxy fight over board seats; targeted repurchase of over 5 percent of the outstanding shares. In addition, the first unnegotiated tender offer cannot be made by another corporation. This constraint eliminates takeovers that might occur for synergistic reasons. An offer by an individual or private partnership cannot be motivated by synergies, but should contain a greater frequency of control actions aimed at disciplining non-value-maximizing managers. This sampling procedure produces 184 “non-synergistic” targets with data on both the *Compustat* and *CRSP* files.

All the target firms in the original sample not included in the “non-synergistic” portfolio are included in the “other takeover” portfolio. The other takeover portfolio contains 359 firms with data on both *CRSP* and *Compustat*. In the multivariate tests, two dummy variables are included: one for the non-synergistic sample and one for the other takeover firms.

The results from the non-synergistic and other takeover portfolios are similar to those reported above. We conduct an F test on equality of the coefficients on the non-synergistic and other takeover dummies. At the 5 percent level, the data reject the null of equality in only one instance out of 33 (inventory, year -1).

The qualitative nature of the results reported in tables 3 through 5 is robust to even finer partitioning of the sample. Table 1 reports 23 percent of the targets are firms whose first control action is a “Targeted share repurchase of over 5 percent of outstanding shares.” We examine whether these transactions are representative of the remaining control actions. The qualitative conclusions of the earlier tests are unchanged when the multivariate tests are repeated after deleting targeted share repurchases.

As another robustness check of the regression findings, we include two additional variables in the regression models. Accounting return on assets (ROA) and book value to cost (the ratio of property, plant, and equipment net of accumulated depreciation to the original cost of property, plant, and equipment) are included in the models to control for possible omitted correlated variables. Both variables are differenced from their industry means. ROA is perhaps a more direct measure of firm performance than COV, RET, RISK, and SIZE. Book value to cost is included to capture systematic differences in the age of the firm’s assets or maturity. The *t*-statistics on the takeover dummy variables (not reported) are slightly more statistically significant when these two variables are added to the regression; the remaining variables are essentially unaffected. We conclude the results in tables 3, 4 and 5 are robust to the inclusion of these variables.

The results are not sensitive to using only firms with all 11 years of accounting methods reported on *Compustat*. Finally, for each firm-year observation we construct a single portfolio of accounting choices using various weighting schemes to combine the three accounting methods (Zmijewski and Hagerman 1981; Sweeney 1994). The previous inferences are unchanged.

V. Conclusions

By examining firms that eventually become takeover targets, this paper is the first to test the relative influence of efficiency and opportunism on accounting choices. Efficiency assumes accounting procedures facilitate internal decision making and control, minimize taxes, reduce costly bond covenant renegotiations, and minimize the costs of expected opportunism. Opportunism assumes income-increasing accounting methods increase managers' wealth at the expense of shareholders. Opportunism is the difference between total opportunism and that expected given the contracts and information available at the time the accounting choices are made.

Other papers have examined the accounting choices of managers involved in corporate control actions (Groff and Wright 1989; DeAngelo 1988), but do not differentiate between opportunism and efficiency. Our research design provides an estimate of the upper bound of opportunism in a random sample by estimating the amount of opportunism in a non-random sample of firms—takeover targets—where accounting opportunism is most likely to exist. Our tests also incorporate variables to control for efficient choice, include more types of corporate control actions over a longer time period, and examine a longer event window of up to 11 years before the control action.

Similar to Groff and Wright (1989) and DeAngelo (1988), we find takeover-target managers select more income-increasing depreciation, inventory and investment tax credit methods than their surviving non-target industry peers. However, the incremental frequency with which target managers select income-increasing accounting methods is small relative to efficiency explanations. This suggests that accounting opportunism is a second-order effect, even in the target sample where opportunism is expected to be most pronounced.

We also find that targets' use of income-inflating methods persists over time. Targets have been using income-inflating methods more frequently than their industry peers for at least 11 years, although the frequency is higher as the takeover event nears. These results reflect the selection bias that is designed into our sampling process; firms suggested by the corporate control literature to have ex-post contained opportunistic managers are selected. Long-standing differences in accounting methods result from managerial opportunism that persists over long periods of time before the market for corporate control identifies such behavior. The selection bias interpretation is also consistent with the negative abnormal capital market returns evidence in the third section. Target firms have systematically under-performed their industry peers for at least 15 years before becoming a target; see especially table 2 and figures 1 and 2.²²

While the market for corporate control appears to take a long time to eliminate opportunistic managers, this is consistent with Palepu (1986), which documents the difficulty of predicting takeover targets using publicly available data. While it is possible that the long-standing tendency of the target firms to choose income-increasing methods is unrelated to opportunism, the multivariate regressions reported in tables 3, 4 and 5 control for any variables that are known to be systematically associated with cross-sectional differences in choice of accounting procedures.

We conclude that efficiency is more important than opportunism in explaining accounting choice. Nonetheless, there are two types of caveats to consider. The first type applies to all studies of accounting procedure choice, while the second type is specific to this study. All studies of accounting procedure choice require assumptions that opportunistic managers choose income-

²² We do not have data on tenure of CEOs in our samples. However, Gibbons and Murphy (1990) report that the median CEO tenure is 7.9 years for 1,631 CEOs representing 916 firms in *Forbes'* compensation surveys. A median tenure of 7.9 years, coupled with our finding of the persistence of income-inflating methods, suggests problems with target firms' internal controls rather than a particular CEO who is opportunistic.

increasing accounting procedures. Presumably these methods increase the present value of executive compensation and reduce the likelihood the CEO is replaced. However, ranking accounting measures according to their income effects, while useful for operationalizing the opportunistic accounting-choice hypothesis, ignores many dimensions of how accounting numbers are used. For example, if value-maximizing managers choose accounting methods that most closely approximate the opportunity cost of the resources consumed (Ball 1989), then value-maximizing managers will rank accounting procedures on their association with opportunity costs, rather than their effect on earnings.²³

Second, interpretation of the results depends on the properties of our estimate of opportunism in the target sample. An unbiased estimate of opportunism in this sample is an estimate of the upper bound on the amount of opportunism in a random sample of surviving firms. However, there are several potential sources of bias in our estimate of opportunism.

One potential bias arises if our maintained hypotheses (takeovers are a device to remove opportunistic managers, and surviving non-takeover targets are the appropriate benchmark for efficient choice) are false. Misclassifications could arise from including (i) value-maximizing managers in the takeover sample and (ii) opportunistic managers in the benchmark sample. In response, we conduct sensitivity analyses using subsets of the sample. After excluding friendly mergers and, in one analysis other takeovers that are potentially synergistic, we find no evidence that any subset of the sample differs in systematic ways from the remainder. Similarly, all the explanatory variables in the multiple regressions are assumed to measure efficiency reasons for accounting choice. If these variables are related to opportunism, or if any misclassifications are related to accounting choice, then the relative importance of opportunism is understated.

Another potential bias results if SIC codes are not the appropriate definition of an industry to benchmark the efficient accounting choice set. SIC codes, which classify firms by production technology, misclassify firms by product markets (Benston 1975). However, if a major determinant of the firm's contracts (including accounting procedures) is the underlying production technology, then SIC codes are probably associated with contracting methods. The three accounting methods we study are primarily determined by production technology. Even if this assumption is inappropriate, there is no obvious directional bias in our estimate of opportunism.

We study only three well understood and visible accounting choices. If, as Healy (1985) suggests, managers manipulate accruals in ways that are hard to monitor, then our approach underestimates the aggregate amount of opportunism in accounting choice more generally. Finally, accounting choices of takeover targets might differ from those of their surviving industry peers in some economic dimensions unrelated to opportunism and not captured in our control variables. If so, such correlated omitted variables cause our estimate of opportunism in the target sample to be biased. Without a more precise theory of what causes takeover actions, and better theories of efficient accounting choice to identify the excluded variables, there is nothing further we can do about these limitations.

Even if our estimates of opportunism are understated, it is unlikely they are biased by the order of magnitude required to invalidate our primary conclusion that efficiency is a more plausible explanation than opportunism for most accounting choices. Of the above caveats, we take use of earnings effects to dichotomize accounting methods most seriously. Most firms are not in financial distress, and economic Darwinism predicts they have sufficient internal controls to provide managers with an incentive to maximize value. If value-maximizing managers judge

²³ Also, some accounting choices, such as consolidation policy, do not affect income yet affect contracts (Mian and Smith 1990a and 1990b).

accounting methods by their effect on taxes, internal decision making and control, then trying to explain choices of accounting procedures with reference to their directional effect on earnings is unlikely to be productive.

Subject to the above caveats, we conclude that our results are consistent both with target managers selecting accounting methods efficiently to reduce taxes and the costs of financial distress, and with the existence of accounting opportunism. However, managerial accounting opportunism is small relative to the frequency of procedure choices we attribute to efficiency, even in our non-random sample specifically chosen to contain a higher than normal frequency of opportunistic managers. We find accounting opportunism to be a second order effect in this sample, and surmise that, in a randomly selected sample, opportunism is an even less important determinant of choice of accounting methods for depreciation, inventory and the ITC.

Independent of whether our research design leads to an unbiased estimate of the upper bound on the amount of opportunism in choice of depreciation, inventory and ITC methods, opportunism is unlikely to explain the time-series changes towards straight-line depreciation, LIFO and the flow through method of accounting for the ITC we observe for surviving firms. Nor is opportunism likely to explain the variation in average choice across industries for surviving firms. Economic Darwinism implies that these time-series and cross-sectional differences require efficiency explanations.

References

- Abdel-khalik, A. 1985. The effect of LIFO-switching and firm ownership on executives' pay. *Journal of Accounting Research* 23: 427-447.
- Alchian, A. 1950. Uncertainty, evolution and economic theory. *Journal of Political Economy* 58 (June): 211-221.
- Antle, R., and A. Smith. 1986. An empirical investigation of the relative performance evaluation of corporate executives. *Journal of Accounting Research* 24 (Spring): 1-39.
- Ball, R. 1989. The firm as a specialist contracting intermediary: Application to accounting and auditing. Working paper, University of Rochester, Rochester, NY.
- Bhide, A. 1989. The causes and consequences of hostile takeovers. *Journal of Applied Corporate Finance* 2 (Summer): 36-59.
- Benston, G. 1975. The baffling new numbers game at the FTC. *Fortune* 92 (October): 174-179.
- Blackwell, D., J. Brickley, and M. Weisbach. 1994. Accounting information and internal performance evaluation: Evidence from Texas banks. *Journal of Accounting & Economics* 17 (May): 331-358.
- Bradley, M., and L. Wakeman. 1983. The wealth effects of targeted share repurchases. *Journal of Financial Economics* 11 (April): 301-328.
- Christie, A. 1990. Aggregation of test statistics: An evaluation of the evidence on contracting and size hypotheses. *Journal of Accounting & Economics* 12 (January): 15-36.
- , M. Joye, and R. Watts. 1993. Decentralization of the firm: Theory and evidence. Working paper, University of Rochester, Rochester, NY.
- Dann, L., and H. DeAngelo. 1983. Standstill agreements, privately negotiated stock repurchases and the market for corporate control. *Journal of Financial Economics* 11 (April): 275-300.
- , and ———. 1988. Corporate financial policy and corporate control: A study of defensive adjustments in asset and ownership structure. *Journal of Financial Economics* 20 (January/March): 87-127.
- DeAngelo, L. 1988. Managerial competition, information costs, and corporate governance: The use of accounting performance measures in proxy contests. *Journal of Accounting & Economics* 10 (January): 3-36.
- Demski, J., J. Patell, and M. Wolfson. 1984. Decentralized choice of monitoring systems. *The Accounting Review* 59: 16-34.

- El-Gazzar, S., S. Lillien, and V. Pastena. 1986. Accounting for leases by lessees. *Journal of Accounting & Economics* 8 (October): 217–237.
- Gibbons, R., and K. Murphy. 1992. Optimal incentive contracts in the presence of career concerns: Theory and evidence. *Journal of Political Economy* 103 (June): 468–505.
- Groff, J., and C. Wright. 1989. The market for corporate control and its implications for accounting policy choice. *Advances in Accounting* 7: 3–21.
- Hagerman, R., and M. Zmijewski. 1979. Some economic determinants of accounting policy choice. *Journal of Accounting & Economics* 1 (August): 141–161.
- Healy, P. 1985. The effect of bonus schemes on accounting decisions. *Journal of Accounting & Economics* 7: 85–107.
- , S. Kang, and K. Palepu. 1987. The effect of accounting procedure changes on CEOs' cash salary and bonus compensation. *Journal of Accounting & Economics* 9: 7–34.
- Holthausen, R. 1990. Accounting method choice: Opportunistic behavior, efficient contracting, and information perspectives. *Journal of Accounting & Economics* 12 (January): 207–218.
- , and R. Leftwich. 1983. The economic consequences of accounting choice: Implications of costly contracting and monitoring. *Journal of Accounting & Economics* 5 (August): 77–117.
- Jensen, M. 1968. The performance of mutual funds in the period 1945–1964. *Journal of Finance* (May): 389–419.
- . 1988. Takeovers: Their causes and consequences. *Journal of Economic Perspectives* 2: 21–48.
- , and W. Meckling. 1976. The theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3: 305–360.
- Klein, A., and J. Rosenfeld. 1988. Targeted share repurchases and top management changes. *Journal of Financial Economics* 20 (January/March): 493–506.
- Maddala, G. 1991. A perspective on the use of limited-dependent and qualitative variables models in accounting research. *The Accounting Review* 66 (December): 788–807.
- Malmquist, D. 1990. Efficient contracting and the choice of accounting method in the oil and gas industry. *Journal of Accounting & Economics* 12: 173–205.
- Mian, S., and C. Smith Jr. 1990a. Incentives for unconsolidated financial reporting. *Journal of Accounting & Economics* 12 (January): 141–171.
- , and ———. 1990b. Incentives associated with changes in consolidated financial reporting requirements. *Journal of Accounting & Economics* 13 (October): 249–266.
- Mitchell, M., and K. Lehn. 1990. Do bad bidders become good targets? *Journal of Political Economy* 98 (April): 372–398.
- Morck, R., A. Shleifer, and R. Vishny. 1988. Characteristics of targets of hostile and friendly takeovers. In *Corporate Takeovers: Causes and Consequences*, edited by A. Auerbach. Chicago, IL: University of Chicago Press.
- , ———, and ———. 1989. Alternative mechanisms for corporate control. *American Economic Review* (September): 842–852.
- Murphy, K., and J. Zimmerman. 1992. Financial performance surrounding CEO turnover. *Journal of Accounting & Economics* 16 (No. 1-3): 273–315.
- Palepu, K. 1986. Predicting takeover targets: A methodological and empirical analysis. *Journal of Accounting & Economics* 8 (March): 3–35.
- Ruback, R. 1988. Do target shareholders lose in unsuccessful control contests? In *Corporate Takeovers: Causes and Consequences* edited by A. Auerbach. Chicago, IL: University of Chicago Press.
- Shivdasani, A. 1992. Board composition, ownership structure, and hostile takeovers. *Journal of Accounting & Economics* 16 (No. 1-3): 167–198.
- Shleifer, A., and R. Vishny. 1988. Value maximization and the acquisition process. *Journal of Economic Perspectives* 2: 7–20.
- , and ———. 1989. Management entrenchment: The case of manager-specific investments. *Journal of Financial Economics* 25: 123–139.
- Skinner, D. 1993. The investment opportunity set and accounting procedure choice: Preliminary evidence. *Journal of Accounting & Economics* 16 (October): 407–445.

- Sloan, R. 1993. Accounting earnings and top executive compensation. *Journal of Accounting & Economics* 16 (No. 1-3): 55-100.
- Sweeney, A. 1994. Debt-covenant violation and managers' accounting responses. *Journal of Accounting & Economics* 17: 281-308.
- Theil, H. 1971. *Principles of Econometrics*. Albany, NY: Wiley.
- Vancil, R. 1978. *Decentralization: Managerial Ambiguity by Design*. Homewood, IL: Dow Jones-Irwin.
- Watts, R. 1974. Accounting objectives. Working paper, University of Rochester, Rochester, NY.
- , and J. Zimmerman. 1986. *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall.
- , and ———. 1990. Positive accounting theory: A ten year perspective. *The Accounting Review* 65 (January): 131-156.
- Weisbach, M. 1988. Outside directors and CEO turnover. *Journal of Financial Economics* 20 (January/March): 431-460.
- White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48: 817-838.
- Whittred, G. 1987. The derived demand for consolidated financial reporting. *Journal of Accounting & Economics* 9 (December): 259-285.
- Zimmer, I. 1986. Accounting for interest by real estate developers. *Journal of Accounting & Economics* 8 (March): 37-51.
- Zmijewski, M., and R. Hagerman. 1981. An income strategy approach to the positive theory of accounting standard setting/choice. *Journal of Accounting & Economics* 3 (August): 129-149.

Aggregation, Specification and Measurement Errors in Product Costing

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SYNOPSIS AND INTRODUCTION: Recent attention has focused on the design of cost systems that improve measurement of product costs. Much of this work has been classified under the general heading of Activity-Based Costing (ABC). There has been little systematic analysis, however, of why an ABC system with multiple cost pools, activity drivers and allocation bases generates more accurate product costs. The intuitive argument rests on the belief that multiple cost pools and multiple activity drivers better reflect the cause and effect relation between overhead resource consumption and products. Our analysis reveals the existence of trade-offs attributable to specification error, aggregation error, errors in measurement of overhead costs and errors in measurement of product-specific units of allocation bases. Our research provides some guidance for implementing ABC systems.

There are two principal results of our analysis. First, partially improving specification of cost allocation bases and increasing the number of cost pools in a costing system can actually increase specification and aggregation errors. Second, reductions in specification and aggregation errors from more disaggregated and better specified costing systems may increase measurement errors and hence errors in product costs.

We assume that firms do not know actual product costs, but rather implement new cost systems by identifying better cost drivers and increasing the number of cost

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pools under an implicit assumption that refinements in the cost system lead to improved accuracy of product cost numbers. This assumption is warranted in many cases. However, our results suggest that such incremental refinements in the cost system may actually cause product cost errors to increase. Therefore, a firm cannot assume that refining its cost system will always lead to more accurate product costs.

Key Words: *Product cost estimation, Activity-based costing, Aggregation errors, Specification errors, Measurement errors.*

SECTION I introduces a model of errors in product cost estimates. To further our intuition, we use a simple numerical example throughout the paper to illustrate the general analysis. Section II uses the example to illustrate specification and aggregation errors in product costs. Section III formalizes the insights derived from the example via a general analysis of errors in estimates of product costs. In section IV, we analyze measurement errors in overhead costs, and section V investigates measurement errors in the cost allocation bases. Section VI discusses the trade-offs among errors and the implications for designing costing systems from a product costing perspective, and presents concluding remarks.

I. Errors in Product Cost Estimates

Specification error arises when the method used to identify costs to products does not reflect the demands placed on resources by individual products. Cost systems have typically allocated overhead costs to products on the basis of volume-based drivers such as direct labor hours or machine hours. To the extent that manufacturing a product requires significant resources that do not vary directly with the volume of production (for example, setups), a volume-based cost system will misspecify the demands placed on overhead resources by individual products (Cooper 1988; Foster and Gupta 1990a).

Aggregation error occurs when costs and units of a resource are aggregated over heterogeneous activities to derive a single cost allocation rate. Heterogeneity arises when individual products use different amounts of resources across cost pools. For example, in the John Deere Component Works (HBS Case No. 9-187-107/8) department-wide setup costs are pooled into a single cost pool and are allocated using the total number of setup hours required by products. The accumulation and allocation of setup costs using a single cost pool exposes the cost system to aggregation errors since the cost of a setup hour at one process used mainly by one set of products may differ considerably from the cost per setup hour at another process used mainly by another set of products.¹

The demand for more refined cost systems, such as ABC systems, arises from the desire to reduce specification and aggregation errors. But refinements of cost systems to reduce these errors may come at the cost of higher measurement errors. That is, improved specifications of cause and effect relations and less aggregation could increase the problems of identifying costs with a particular cost pool and measuring the specific units of resources consumed by individual

¹ Aggregation error could be viewed as a special case of specification error. However, for expositional purposes we distinguish between aggregation error and specification error. Our definition of aggregation parallels the way aggregation has been defined in much of the accounting literature—adding together of similar cost drivers. Specification has more to do with cause-and-effect, interpreted in our framework as arising from the choice of the wrong cost driver rather than from aggregation. In the John Deere example illustrated above, the aggregation error may not reduce to zero even after controlling for the specification error for setup activities.

products. Information on the exact cost or the nature of resource usage at less aggregate cost pools are often difficult to obtain (see for example, Foster and Gupta 1990a).

Measurements of costs or units of allocation bases are further complicated when variables to be measured are not supported by well-defined measurement guidelines or measurement techniques. For example, consider setup costs. Computing total costs incurred in setups requires estimates of the percentage of time spent by various staff functions such as supervisors, quality control specialists, and product and process design engineers on setup activities. The firm typically estimates the time spent on setups on the basis of questionnaires and interviews (for example, see Cooper et al. 1992), and these estimates are subject to measurement error.

Establishing the nature and sources of errors allows us to analyze trade-offs across these errors.² We demonstrate that the product cost information available for decision making does not necessarily improve as a firm partially refines its costing systems through changes in cost allocation bases and disaggregation of cost pools.

Several caveats are in order before we proceed with the analysis. First, we do not model any strategic influences of costs on pricing or managerial behavior which might affect the demand for the level of disaggregation in cost systems.³ Second, we ignore all transaction costs of implementing more or less detailed and refined systems. To the extent these transaction costs are significant, the threshold benefit requirement of a more sophisticated system will be correspondingly larger (Dewan and Magee 1992). Third, we do not explicitly incorporate non-linearity and jointness of cost behavior. These considerations are not essential to the basic points we wish to make in this paper.

II. The Example

Consider a manufacturing process consisting of two departments, each having a setup and a machining process. Suppose that the plant manufactures one unit each of two products, product A and product B.⁴ Further suppose the cost driver for departmental setup costs is the setup hours in each department and the cost driver for departmental machining costs is the machine hours in each department. Panel A of table 1 gives values for the number of setups, setup hours, direct machining labor hours (henceforth, direct labor hours) and machine hours used by products, and the total costs at the four processes.

To compare alternative costing systems, we evaluate the total error in the cost of a product resulting from each costing system. The costing systems vary with respect to the level of correctness in the specification of cost allocation bases and the degree of aggregation of cost pools (single versus multiple cost pools).

Benchmark Costs

Evaluation of errors requires a benchmark. The relevant benchmark in our analysis is the actual product cost based on the setup hours and machine hours required by a product in each

² Trade-offs between aggregation errors and measurement errors are also recognized by Grunfeld and Griliches (1960) and Aigner and Goldfeld (1974) in the estimation of macro parameters, and by Lim and Sunder (1990, 1991) in the context of asset valuation.

³ For example, in cost-based reimbursement environments, such as in defense contracting and utility industries, firms may have incentives to use costing systems that allow them to systematically distort product cost information. Strategic considerations also play a role in designing a costing system when the primary objective is to influence usage of some specific overhead resources (see, Zimmerman 1979; Cooper and Turney 1990; Merchant and Shields 1993) or to influence competition in oligopolies (see, Alles and Datar 1993; Banker and Potter 1993).

⁴ One unit per product is an assumption made for analytical simplicity. The analysis directly extends to multiple units of products without affecting our basic results.

Table 1
Values for the Resource Usage by Products and Benchmark Product Costs

Products	Department 1		Department 2		Total
	Setup	Machining	Setup	Machining	
Panel A: Resource Usage and Process Costs					
Number of setups					
A	7	-	3	-	10
B	<u>13</u>	-	<u>2</u>	-	<u>15</u>
Total	20		5		25
Setup hours					
A	15	-	6	-	21
B	<u>15</u>	-	<u>4</u>	-	<u>19</u>
Total	30	-	10	-	40
Direct labor hours					
A	-	32	-	34	66
B	-	<u>18</u>	-	<u>16</u>	<u>34</u>
Total		50		50	100
Machine hours					
A	-	115	-	120	235
B	-	<u>85</u>	-	<u>80</u>	<u>165</u>
Total		200		200	400
Panel B: Benchmark Costs					
Total process costs					
	\$3,000	\$8,000	\$2,000	\$2,000	\$15,000
Cost drivers	setup hrs.	machine hrs.	setup hrs.	machine hrs.	
Cost rates ¹	\$100/hr.	\$40/hr.	\$200/hr.	\$10/hr.	
Allocations ²					
A	\$1,500	\$4,600	\$1,200	\$1,200	\$8,500
B	<u>\$1,500</u>	<u>\$3,400</u>	<u>\$ 800</u>	<u>\$ 800</u>	<u>\$6,500</u>
Total	\$3,000	\$8,000	\$2,000	\$2,000	\$15,000

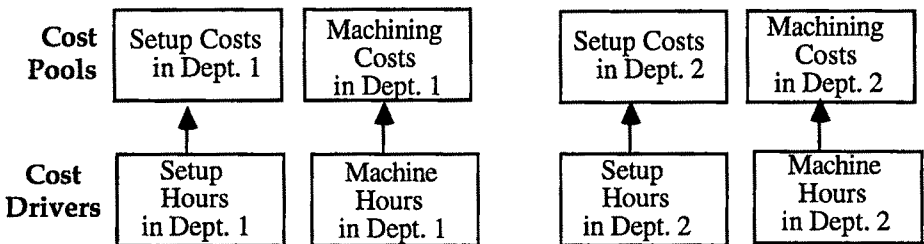
¹ Cost rates = Total process costs / Total cost driver units.

² Cost allocation = Cost rate x Driver units.

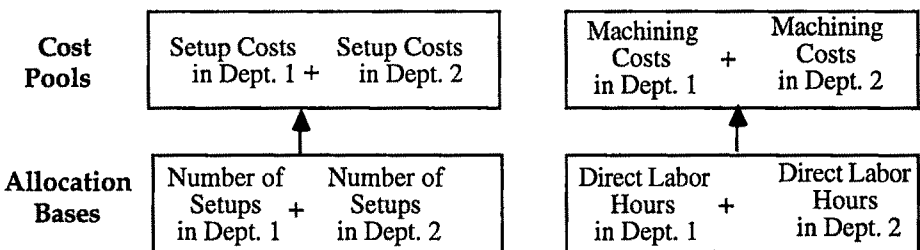
For example, \$1,500 cost allocated to product A at the setup process in department 1 is given by multiplying 15 setup hours used by product A at the setup process in department 1 by the cost rate of \$100 per setup hour for the setup process in department 1.

Figure 1

Panel A: Cost Pools and Cost Drivers under the Benchmark Costing System



Panel B: Cost Pools and Allocation Bases under CS1



department (see panel A of figure 1). These benchmark costs are generally very costly to obtain and hence unobservable to firms in most cases.

Panel B of table 1 gives the benchmark costs (denoted by *). TC denotes the total cost of a product and the subscript of TC identifies the product.

$$TC_A(*) = \$8,500; \quad TC_B(*) = \$6,500. \quad (1)$$

Comparison of Product Costs Allocated under Alternative Costing Systems

To begin the analysis, suppose the firm has a process-based costing system (CS1) which aggregates setup costs in both departments into a setup cost pool and machining costs in both departments into a machining cost pool. As illustrated in panel B of figure 1, costs are allocated to products using the number of setups and direct labor hours which are different from the benchmark drivers of costs. Product costs under the CS1 system are given in panel A of table 2.

$$TC_A(CS1) = \$8,600; \quad TC_B(CS1) = \$6,400. \quad (2)$$

There is a difference of \$100 in costs allocated to each of the two products under the benchmark system relative to the CS1 system. We next analyze reasons for these cost differences.

Specification and Aggregation Errors

We begin by considering only specification and aggregation errors, ignoring measurement errors for the moment. We show that, in the absence of measurement errors, the difference between the benchmark cost of a product and the cost allocated to that product under an alternative costing system is the sum of the specification and aggregation errors.

Table 2
Product Costs Under Alternative Costing Systems

Products		Setup		Machining		Total
		Dept. 1	Dept. 2	Dept. 1	Dept. 2	
Panel A: Costing System 1 (CS1)						
Pooled Costs		\$5,000		\$10,000		\$15,000
Allocation base		number of setups		direct labor hrs.		
Allocation rate ¹		\$200/setup		\$100/dl. hr.		
Usage:	A	10		66		
	B	<u>15</u>		<u>34</u>		
	Total	25		100		
Allocations:	A	\$2,000		\$6,600		\$8,600
	B	\$3,000		\$3,400		\$6,400
Panel B: Costing System 1' (CS1')						
Pooled Costs		\$3,000	\$2,000	\$8,000	\$2,000	\$15,000
Allocation base		no. of setups	no. of setups	dir. lab. hrs.	dir. lab. hrs.	
Allocation rate ¹		\$150/setup	\$400/setup	\$160/dl. hr.	\$40/dl. hr.	
Usage:	A	7	3	32	34	
	B	<u>13</u>	<u>2</u>	<u>18</u>	<u>16</u>	
	Total	20	5	50	50	
Allocations:	A	\$1,050	\$1,200	\$5,120	\$1,360	\$8,730
	B	\$1,950	\$ 800	\$2,880	\$ 640	\$6,270
Panel C: Costing System 2 (CS2)						
Pooled Costs		\$5,000		\$10,000		\$15,000
Allocation base		no. of setups		machine hrs.		
Allocation rate ¹		\$200/setup		\$25/machine hr.		
Usage:	A	10		235		
	B	<u>15</u>		<u>165</u>		
	Total	25		400		
Allocations:	A	\$2,000		\$5,875		\$7,875
	B	\$3,000		\$4,125		\$7,125
Panel D: Costing System 3 (CS3)						
Pooled Costs		\$5,000		\$8,000		\$15,000
Allocation base		no. of setups		machine hrs.		
Allocation rate ¹		\$200/setup		\$40/mch. hr.		
Usage:	A	10		115		
	B	<u>15</u>		<u>85</u>		
	Total	25		200		
Allocations:	A	\$2,000		\$4,600		\$7,800
	B	\$3,000		\$3,400		\$7,200

¹ Allocation rate = Total cost at the cost pool / total units of allocation base at the cost pool.

To calculate the individual amounts of the specification error and the aggregation error in costing products under the CS1 system, we first compute product costs using the number of setups and direct labor hours as the allocation bases at the individual setup and machining processes (see panel B of table 2). We denote this cost by CS1'.

$$TC_A(CS1') = \$8,730; \quad TC_B(CS1') = \$6,270. \quad (3)$$

The specification error (denoted by SE) and the aggregation error (denoted by AE) in computing the cost of product A under the CS1 system are given as:

$$SE_A(CS1) = TC_A(*) - TC_A(CS1') = \$8,500 - \$8,730 = -\$230. \quad (4a)$$

$$AE_A(CS1) = TC_A(CS1') - TC_A(CS1) = \$8,730 - \$8,600 = \$130. \quad (4b)$$

The total error (denoted by TE) in the cost of product A is the sum of specification and aggregation errors of product A under the CS1 system:

$$\begin{aligned} TE_A(CS1) &= TC_A(*) - TC_A(CS1), \\ &= SE_A(CS1) + AE_A(CS1) = -\$230 + \$130 = -\$100. \end{aligned} \quad (5)$$

Line 2 of panel A and panel B in table 3 summarize the specification errors, aggregation errors and total errors for products A and B under the CS1 system. Under the CS1 system, the allocation base "direct labor hours" overallocates machining costs to product A by \$800 (\$4,600 + \$1,200, table 1, panel B minus \$6,600, table 2, panel A), consisting of an overallocation of \$680 (\$4,600 + \$1,200, table 1, panel B minus \$5,120 + \$1,360, table 2, panel B) due to misspecification of the drivers of costs for the machining processes, and an overallocation of \$120 (\$5,120 + \$1,360, table 2, panel B minus \$6,600, table 2, panel A) due to aggregation of two machining processes into a single machining cost pool. The allocation base "number of setups" underallocates setup costs to product A by \$700 which consists of an underallocation of \$450 due to misspecification of the drivers of costs for the setup processes, and an underallocation of \$250 due to aggregation of two setup processes into a single setup cost pool. The overallocation in the machining costs to product A at the machining cost pool is partially canceled by underallocation of setup costs at the setup cost pool. The net result is an overallocation of cost to product A by \$100.

Change in the Specification of Cost Allocation Base

Suppose the firm adopts CS2 as the costing system, where CS2 uses the machine hours as the cost allocation base for the machining cost pool and the number of setups as the cost allocation base at the setup cost pool. CS2 has the same number of cost pools as CS1 but has an improved specification of the cost driver for the machining cost pool. Firms often tend to modify cost systems in this incremental way (by improving cost driver specification for large account categories) since the costs of completely changing cost systems can be quite large (Dewan and Magee, 1992). The CS2 system allocates \$7,875 (an underallocation) of manufacturing costs to product A (see panel C of table 2) leading to a total error of \$625.

$$TE_A(CS2) = TC_A(*) - TC_A(CS2) = \$8,500 - \$7,875 = \$625. \quad (6)$$

Changing the specification at the machining cost pool to "machine hours" under CS2 eliminates the specification error (overallocation of machining costs by \$680) in product A costs at the machining cost pool. Furthermore, the aggregation error in machining costs of product A under the CS1 system (overallocation of machining costs by \$120) reduces to an overallocation of \$75 under the CS2 system (now with respect to machine hours). The underallocation of costs (\$700) to product A at the setup pool remains the same as in the CS1 system. Under the CS2 system, the overallocation of costs to product A at the machining cost pool is not large enough

Table 3
Error in Estimates of Product Costs under Alternative Costing Systems

Costing System	Product Cost	Setup Costs		Machining Costs		Interaction Effect ³	Total Error ⁴
		SE ¹	AE ²	SE ¹	AE ²		
Panel A: Product A							
Benchmark	\$8,500	0	0	0	0	-	0
CS1	\$8,600	\$450	\$250	-\$680	-\$120	-	-\$100
CS2	\$7,875	\$450	\$250	0	-\$75	-	\$625
CS3	\$7,800	\$450	\$250	0	0	-	\$700
Panel B: Product B							
Benchmark	\$6,500	0	0	0	0	-	0
CS1	\$6,400	-\$450	-\$250	\$680	\$120	-	\$100
CS2	\$7,125	-\$450	-\$250	0	\$75	-	-\$625
CS3	\$7,200	-\$450	-\$250	0	0	-	-\$700
Panel C: Average Squared Error							
Benchmark	-	0	0	0	0	0	0
CS1	-	202,500	62,500	462,400	14,400	-641,800	10,000
CS2	-	202,500	62,500	0	5,625	120,000	390,625
CS3	-	202,500	62,500	0	0	225,000	490,000

¹ SE denotes specification error.

² AE denotes aggregation error.

³ Interaction between errors at the setup and the machining cost pools.

⁴ Total error in cost of a product is computed relative to the benchmark cost of the product.

to offset the underallocation of costs to product A at the setup cost pool. This results in a higher total error in the cost of product A under the CS2 system. Line 3 of panels A and B in table 3 summarize the specification errors, aggregation errors and total errors for products A and B under the CS2 system.

Despite improving the specification of the allocation base at the machining cost pool, CS2 results in a higher specification error and a higher total error compared to the CS1 system. This example serves to illustrate that improving the specification in a cost system may neither reduce the specification error in individual product costs, nor reduce the total error in the costs of individual products.

Disaggregation of Cost Pools

Suppose the firm modifies the CS2 system as follows. It allocates machining costs at each machining process using machine hours at *each* process as the cost allocation base. The firm continues to allocate setup costs to products using the number of setups as it did in the CS1 and CS2 costing systems. This new cost procedure is called the CS3 system.

CS3 has the same specification of allocation bases as CS2 but CS3 allocates machining costs at a more disaggregated level than CS2. Panel D of table 2 gives product costs under the CS3 system. The total error (an underallocation) in cost of product A under CS3 is:

$$TE_A(CS3) = TC_A(*) - TC_A(CS3) = \$8,500 - \$7,800 = \$700 \quad (7)$$

Disaggregating the machining cost pool into two pools corresponding to each machining process under CS3 eliminates the aggregation error at the machining cost pool (overallocation of costs by \$75) under CS2. This leaves a larger uncanceled underallocation of costs at the setup cost pool resulting in a higher total error in the costs of product A under the CS3 system. Line 4 of panels A and B in table 3 summarize the specification errors, aggregation errors and total errors for products A and B under the CS3 system.

Despite improving the specification of allocation bases and using more disaggregated cost pools, CS3 results in a higher total error for product A than the other two ABC systems. If the firm does not know the true costs of products A and B, then it also does not know that the CS3 system leads to less accurate product costs.

The following three observations summarize the insights from our example.

1. Specification errors in product costs do not always decrease with improved specifications of cost allocation bases (drivers) at aggregate cost pools.
2. Aggregation errors in product costs do not always decrease with an increase in the number of cost pools.
3. Total errors in product costs do not always decrease with improved specifications of cost allocation bases or with greater disaggregation of cost pools.⁵

⁵ Note that a single overhead cost pool and direct labor hour-based costing system would allocate $\$9,900 \left(\frac{\$15,000}{100} \times 66 \right)$ to product A and \$5,100 to product B $\left(\frac{\$15,000}{100} \times 34 \right)$. Consequently, in our example, the CS1 system which is better specified and more disaggregate than the direct labor hour-based system has smaller error in product costs. Our analysis of specification and aggregation errors, however, suggest that this need not necessarily be the case. For example, a single overhead cost pool and direct machine hour-based costing system would allocate $\$8,812.50 \left(\frac{\$15,000}{400} \times 235 \right)$ to product A and $\$6,187.50 \left(\frac{\$15,000}{400} \times 165 \right)$ to product B. Both CS2 and CS3 systems which are better specified and more disaggregated than the machine hour-based system have larger errors in product costs.

Incremental changes in cost systems are often the norm rather than the exception (Cooper 1988, 1989). The typical approach seeks better specifications for and greater disaggregation of large overhead cost pools in the belief that a more refined analysis of these large overhead cost categories constitutes a cost effective way to improve the accuracy of product costs. Firms regard redesigning the entire cost accounting system in a completely well-specified, highly-disaggregated, and fully-refined way as impractical and economically infeasible, in part, due to problems of availability and measurement of information, interdependencies, and poorly defined relations between costs and drivers. (See for example, Foster and Gupta 1990b; Cooper et al. 1992.) Our analysis in this section illustrates that incremental "improvements" (better specification and greater disaggregation) may result in higher rather than lower errors in product costs. A key question remains. How frequently will the phenomenon identified in our example occur? That is, in an *ex-ante* sense, does the example represent an exception or a likely case? The general analysis in the next section seeks answers to these questions.

III. A General Analysis

Consider a manufacturing process that produces one unit each of n products (indexed by $j = 1, 2, \dots, n$) using resources at m distinct processes (indexed by $i = 1, 2, \dots, m$). Let Q_i be the cost driver at process i . Let q_{ij} denote the units of cost driver inputs used by product j at process i ($q_{ij} \geq 0$), and q_i denote the total input units used at process i ($q_i = \sum_j q_{ij}$). Let c_i be the cost per unit of Q_i and C_i be the total costs of inputs used at process i ($C_i = c_i q_i$).⁶ The total manufacturing cost incurred on product j at m cost pools (one for each manufacturing process) is given by $TC_j(m) = \sum_{i=1}^m c_i q_{ij}$.

Suppose the cost system uses K cost pools ($1 \leq K \leq m$), indexed by $k = 1, 2, \dots, K$. Let OH_k be the accumulated costs of processes pooled in pool k . Total costs remain unchanged, so $\sum_i C_i = \sum_k OH_k$. Costs at pool k are allocated to products using an allocation base P_k that proxies for the resource usages of processes whose costs are included in pool k . Let p_{kj} denote the units of P_k used by product j and p_k denote the total units of P_k used at pool k ($p_k = \sum_j p_{kj}$). The total manufacturing cost allocated to product j using K cost pools is given by $TC_j(K) = \sum_{k=1}^K r_k p_{kj}$, where $r_k = OH_k / p_k$ is the cost allocation rate at pool k .⁷

Analysis of Errors in Costs of a Single Product

The total error (TE) in costs allocated to product j under a K cost pool system is:

$$TE_j(K) = TC_j(m) - TC_j(K) = \sum_i c_i q_{ij} - \sum_k r_k p_{kj} = \sum_i \frac{C_i}{q_i} q_{ij} - \sum_k \frac{OH_k}{p_k} p_{kj}. \quad (8)$$

Intuitively, it seems that the objective of cost system modifications is to reduce the total error (TE_j) in product costs by changing specification (the allocation bases p_k) and/or the level of aggregation (the number of cost pools K). Since a partial redesign of the cost system does not remove the total error, it is an open question whether this objective will be met. We refer to the part of TE_j *not affected* (or removed) by cost system redesign as TE_j^2 , and the part *removed* (or reduced to zero) as TE_j^1 . The following observation formalizes the effect of this incremental change in the cost system on the magnitude of product cost error:⁸

⁶ For the sake of analytical simplicity, we assume linear and separable production costs.

⁷ We focus on the class of costing models that use linear allocation of costs for standard consumption of resources. Linear allocations are widely employed by costing systems, and the use of standard costs enables us to circumvent factors that are outside the estimation model, such as changes in input prices.

⁸ Proofs and supporting calculations for observations are available from the authors, on request. Proofs of propositions are given in the appendix.

Observation 1:

- A: When both TE_j^1 (the affected) and TE_j^2 (the unaffected) errors are of the same sign, a reduction in TE_j^1 to zero will *always decrease* the absolute magnitude of total error in the cost of product j .
- B: When TE_j^1 and TE_j^2 are of opposite signs and TE_j^1 is larger in absolute magnitude than TE_j^2 , a reduction of TE_j^1 to zero will decrease the absolute magnitude of total error in the cost of product j *iff* TE_j^2 is smaller in absolute magnitude than the existing total error, that is, $|TE_j^2| < |TE_j^1 + TE_j^2|$.
- C: When TE_j^1 and TE_j^2 are of opposite signs and TE_j^1 is smaller in absolute magnitude than TE_j^2 , a reduction in TE_j^1 to zero will *always increase* the absolute magnitude of the total error.

Two factors contribute to higher errors under a modified costing system in cases B and C: (i) the opposite signs of TE_j^1 and TE_j^2 , and (ii) the relative magnitudes of TE_j^1 and TE_j^2 . *Cross-cancellation* of errors occurs across TE_j^1 and TE_j^2 , and a reduction in TE_j^1 reduces the amount by which TE_j^2 is canceled. If TE_j^1 partially offsets TE_j^2 (i.e., $|TE_j^1| < |TE_j^2|$) then eliminating TE_j^1 can only increase total error as it takes away the counter-effect of TE_j^1 on TE_j^2 .

In the context of our previous example, the CS1 system's existing total error of \$100 in the cost of product A is comprised of two components: an overallocation of costs at the machining cost pool (-\$800, the TE_A^1 error), and an underallocation of costs at the setup cost pool (\$700, the TE_A^2 error). Using an improved specification of the cost allocation base for the machining cost pool under the CS2 system reduces the error in machining costs of product A from -\$800 to -\$75. The error at the setup cost pool, however, remains unchanged, at \$700. The result is a lower cancellation of error at the setup pool and a higher total error of \$625 in the cost of product A under the CS2 system as described in Observation B.

Similarly, in going from CS2 to CS3, the -\$75 error in computing the cost of product A at the machining cost pool is completely eliminated. There is no cancellation of TE_A^2 error at the setup cost pool, so the net result is a further increase in the total error from \$625 to \$700. (See Observation C.)

Field-based research has noted the phenomenon of cross-cancellation of errors portrayed in our example. Gupta (1993) compares differences in product costs between a single cost pool-single cost driver-based system and a multiple cost pool-multiple cost driver-based system. He finds that more than 80 percent of errors at individual activity-level cost pools offset each other for nearly half of the products at his field site.

Observation 1 provides a structure to help frame our example, but it does not indicate the *ex-ante* likelihood of total error TE_j increasing as TE_j^1 is reduced. An *ex-ante* analysis focuses on expectations rather than particular *ex-post* realizations. By considering a set of possible realizations, we show that refinements in costing systems will often reduce total error. However, the phenomenon described in our example also occurs with non-trivial probability. Throughout this section we restrict ourselves, for expositional simplicity, to two products.

We assume that the TE_j^1 error is uniformly distributed over the range $[-a, a]$ where a and $-a$ represent the maximum amounts by which TE_j^1 undercosts or overcosts the product, respectively. We further assume that the TE_j^2 error follows a uniform distribution over the range $[-b, b]$. We can interpret these distributions as subjective probabilities that the controller assesses about the TE_j^1 and TE_j^2 errors. Alternatively, the distributions may represent cross-sectional variations in these errors across firms, so we can study the probability of total error TE_j increasing as firms reduce

the TE_j^1 component of the error to zero.⁹ Consistent with our example, we continue to assume a deterministic production function.

The specific realizations in our example relate to the distributions described in the previous paragraph as follows. The error in machining costs of product A (under CS1) reduces to zero under CS3 and is denoted by $TE_A^1 = -\$800 \in [-a, a]$. The error in the setup costs for product A (under CS1) is unaffected by the change to CS3 and is denoted by $TE_A^2 = \$700 \in [-b, b]$.

Proposition 1. If TE_j^1 and TE_j^2 are independently and uniformly distributed over the ranges $[-a, a]$ and $[-b, b]$, respectively, the probability that the total error TE_j at a firm will increase when TE_j^1 is reduced to zero is given by $\frac{4b-a}{8b}$ for $a \leq 2b$ and $\frac{b}{2a}$ for $a > 2b$.

The probability of TE_j increasing as TE_j^1 decreases to zero increases as the maximum error b (that remains unchanged) approaches or exceeds the maximum affected error a . When a equals b , reducing TE_j^1 to zero will increase TE_j with a 37.5% probability. The total error decreases (in probabilistic terms) in the cases of firms for which error ranges at cost pools where improvements are implemented are larger than the error ranges at cost pools that remain unchanged.¹⁰ Note, that the probability of an increase or decrease in errors in Proposition 1 depends on the relative magnitude of error ranges that are corrected (not corrected) and not on the relative sizes of cost pools that are modified in the processes of changing cost systems. Firms stand a better chance of reducing total errors by identifying and focusing cost system refinements on processes that are likely to have the largest errors.¹¹ Proposition 1 also suggests that the example presented in section II describes a plausible scenario. Incremental refinements in cost system designs could indeed increase errors in product costs.

Analysis of Average Errors across Products

The measure of total error in the cost allocated to individual products may be useful for product specific decisions. Such a measure, however, is limiting for a designer of a costing system who wants to minimize errors in allocated costs across all products. We use average squared error (ASE) as a metric to evaluate errors in costing products in a K-pool costing system:¹²

$$\begin{aligned} ASE(K) &= \frac{1}{n} \sum_j (TC_j(m) - TC_j(K))^2, \\ &= \frac{1}{n} \sum_j \left(\sum_i c_i q_{ij} - \sum_k r_k p_{kj} \right)^2 = \frac{1}{n} \sum_j \left(\sum_i \frac{C_i}{q_i} q_{ij} - \sum_k \frac{OH_k}{p_k} p_{kj} \right)^2, \end{aligned} \quad (9)$$

where the average is taken over products.

⁹ We thank Jack Hughes for discussions on this point.

¹⁰ The basic insights from the symmetric uniform distribution appear to be robust to different distributional assumptions. For example, similar conclusions hold when the error structure is generalized to non-symmetric uniform distributions with ranges $(-a_1, a_2)$, $a_1 \neq a_2$, and $(-b_1, b_2)$, $b_1 \neq b_2$. The probability of an increase in the total error following a decrease in TE_j^1 continues to be significant if the probability of error decreases in the tails of the ranges $[-a, a]$ and $[-b, b]$ as in the case of the triangular distribution.

¹¹ For example, when designing its new process-based product costing system, PROKASTA, Siemen's Electric Motor Works (HBS Case No. 9-189-089) added only two new cost pools, an order processing cost pool and a special components cost pool. These cost pools accounted for only 15 percent of total manufacturing overhead costs. Why focus on these cost pools? Presumably because the old allocation base was a poor driver of order processing and special components costs and hence was the major cause of errors in product costs. The other allocation bases in the old system were good drivers of other manufacturing overhead costs. Proposition 1 suggests that Siemen's refined cost system is likely to achieve more accurate product costs even though the 'corrected' costs represent only a small percentage of total overhead costs.

¹² The average error in product costs (across products) is always zero because the total costs allocated to products under a K cost pool system are the same as the total costs assigned to products at each individual process.

Our choice of a symmetric quadratic loss function is motivated by several reasons. First, from an economic consequences point of view researchers have argued that the loss function associated with errors in cost information are a symmetric quadratic function in monopolies, oligopolies, and in markets characterized by monopolistic competition.¹³ Second, symmetric quadratic loss functions are supported by tractable properties and are widely used in accounting measurements (Ijiri 1975), and in valuation models (Lim and Sunder 1990, 1991). The loss in individual product costs is equally weighted for the sake of analytical simplicity. The analysis can be extended, without changing the basic results, to models that assign different weights to errors in costs of different products.

Panel C of table 3 provides values of ASE for different costing systems described in the example in the previous section. ASE increases from \$10,000 under the CS1 system to \$390,625 under the CS2 system and then to \$490,000 under the CS3 system. The example illustrates that the average squared error in product costs does not always decrease with improved specification of cost allocation bases or with disaggregation of cost pools. The following discussion provides a formal analysis of the behavior of ASE consequent to changes in cost system designs.

Let the total cost of processes pooled in cost pool k equal $OH_k = \sum_{i \in k} C_i$. We denote the error in the costs of product j at the k th cost pool by $TE_j(k) = \sum_{i \in k} c_i q_{ij} - r_k p_{kj}$. Suppose cost pool k is disaggregated into separate cost pools for each individual process, each with its own cost driver. Further suppose the costs and allocation methods at all other cost pools remain unchanged. Under the modified costing system, $TE_j(k)$ reduces to zero for every product. Let $ASE(K')$ denote the average squared error under the modified costing system. The difference between $ASE(K)$ and $ASE(K')$ represents the effect of cost system modifications on errors in product costs:

$$\begin{aligned} ASE(K) - ASE(K') &= \frac{1}{n} \sum_j \left(\sum_i c_i q_{ij} - \sum_k r_k p_{kj} \right)^2 \\ &\quad - \frac{1}{n} \sum_j \left(\sum_i c_i q_{ij} - \sum_{k'} r_{k'} p_{k'j} - \sum_{i \in k} c_i q_{ij} \right)^2, k' \neq k, \\ &= \frac{1}{n} \sum_j \left(\sum_{i \in k} c_i q_{ij} - r_k p_{kj} \right)^2 \\ &\quad + \frac{2}{n} \sum_j \left(\sum_{i \in k} c_i q_{ij} - r_k p_{kj} \right) \left(\sum_{k'} \left(\sum_{i \in k'} c_i q_{ij} - r_{k'} p_{k'j} \right) \right), k' \neq k. \end{aligned} \quad (10)$$

Let X denote the first term of the sum and $2Y$ denote the second term of the sum on the right hand side of equation (10). X is the squared error in product costs at the k th cost pool. As such, $X \geq 0$. Y is the sum of covariations between the error in product costs at the k th pool and errors in product costs at other cost pools. Equation (10) illustrates that the benefits of eliminating error X at the k th cost pool would depend on the sign and magnitude of covariations of X with errors in product costs at other cost pools.

If Y is positive or zero, a reduction of X to zero will reduce $ASE(K)$. This result is similar to Observation (1A) made for a single product. If Y is negative and greater than $X/2$ in absolute magnitude then a reduction of X to zero will always increase ASE , a result similar to Observation (1C).

A positive Y arises from net positive covariations between errors at the k th pool and errors at other cost pools. For example, Y will be positive if products that are overcosted (undercosted) at the k th pool are also overcosted (undercosted) at other cost pools, and vice versa. Y is negative if products that are overcosted (undercosted) at the k th pool are undercosted (overcosted) at other

¹³ See Vives (1990), Alles and Datar (1993), Banker and Potter (1993), Dewan and Magee (1992) and Hwang et al. (1993).

cost pools, and vice versa. Y is zero when the errors in product costs at the k^{th} pool are independent of errors in product costs at all other cost pools. Such negative covariations in errors in costs allocated to products across processes are commonly found in settings where the manufacturing process uses both labor intensive and machine intensive technologies (see for example, Gupta 1993). Our analysis illustrates that when there are negative covariations in products' resource usages across processes, refinements to a cost system aimed at reducing part of the total error could, in fact, result in less accurate product costs.¹⁴

IV. Measurement Error in Overhead Costs

Some overhead costs can be directly traced to cost pools and can be collected separately and specifically in each cost pool. In other cases, estimates of the cost of resources devoted specifically to an activity are susceptible to measurement errors. In the setup example discussed in the introduction, determining the cost of the setup activity requires estimates of the percentage of time spent by supervisors, maintenance engineers and quality control specialists on the setup activity. In this section, we examine the implications of measurement errors in overhead cost pools on product costs.

To illustrate the effect of measurement error in overhead costs on cost system accuracy, we revisit the example discussed in section II. Suppose CS1 undercharges the setup cost pool by \$1,200 and overcharges the machining cost pool by \$1,200. The total cost across the two cost pools (\$15,000) remains unchanged. Since product A uses proportionally more of total direct labor hours than total number of setups (see panel A of table 1), and because the assumed measurement error reduces the costs allocated to the setup cost pool, product A attracts higher total costs. The reverse holds for product B. The costing system allocates \$8,912 to product A and \$6,088 to product B, resulting in higher errors (\$412) for each product compared to the product cost error of \$100 (see panel A of table 2), absent measurement errors in overhead costs.¹⁵

We extend the example in two ways. First, we model measurement errors as random variables with zero mean and some variance-covariance structure. Note that the uncertainty spans all possible realizations of the measurement error in overhead costs, while the example only considers a specific realized value of the measurement error. Second, we use the average squared error metric to investigate the effect of measurement error in overhead costs across all products, while the example focuses on each product separately.

Let e_k denote a random error in the measurement of cost OH_k at cost pool k . We make the following assumptions about e_k :

(4.1) Total costs are computed accurately without any measurement error, that is,

$$\sum_k (OH_k + e_k) = \sum_k OH_k, \text{ or, } \sum_k e_k = 0. \quad (11)$$

(4.2) e_k is distributed randomly with mean $E(e_k) = 0$, variance $V(e_k) = \sigma_k^2$, and covariance $\text{Cov}(e_k, e_{k'}) = \delta_{kk'} \quad \forall \quad k, k' \in K$. (12)

(4.3) e_k is distributed independently of the costs at each cost pool k and the costs at each process i , that is,

¹⁴ We assume that costs of a process are pooled in one and only one cost pool, i.e., $OH_k = \sum_{i \in k} C_i$. It can be shown that without this assumption, given sufficient information, it is possible to modify a costing system such that the resulting ASE in product costs is no greater than the ASE in product costs under the original system. However, this requires information about individual processes, their costs, their drivers and the distributional behavior of the drivers. The designer of a costing system will rarely have all this information. Furthermore, even if the information is available, it is not clear if the problem of an optimal cost system design can be solved in an economically feasible way (see Dewan and Magee 1992 for a detailed discussion of this issue).

¹⁵ The computations use the methodology described in panel A of table 2 to calculate costs under CS1. The cost allocation rates are, however, different because of the measurement error in overhead cost pools.

$$E_k(e_k \cdot OH_k) = 0 \quad \forall \quad k, k' \in K, \text{ and } E_k(c_i \cdot C_i) = 0 \quad \forall \quad i \in m, \text{ and } k \in K. \quad (13)$$

Assumption (4.2) states that errors are not systematic or designed into the overhead costs at the cost pools. If errors are systematic and known, the costing system can be modified to counter the effect of errors. Assumption (4.3) says that the size of a cost pool does not determine systematically the magnitude of errors in the measurement of costs at the cost pool. Errors in costs can be small at large cost pools or large at small cost pools.

Under assumptions (4.1) through (4.3) the average mean squared error in product costs ($\hat{AMSE}$) can be separated into (i) errors due to aggregation and misspecification (ASE), and (ii) errors due to inaccurate measurement of overhead costs (AMSEOH).¹⁶ That is,

$$\begin{aligned} \hat{AMSE}(K) &= \frac{1}{n} \sum_j E \left(\sum_i c_i q_{ij} - \sum_k \frac{(OH_k + e_k)}{p_k} p_{kj} \right)^2, \\ &= \frac{1}{n} \sum_j \left(\sum_k \sum_{i \in k} c_i q_{ij} - \sum_k \frac{OH_k}{p_k} p_{kj} \right)^2 + \sum_k \sum_{k'} \delta_{kk'} \frac{1}{n} \sum_j \left(\frac{p_{kj}}{p_k} \cdot \frac{p_{k'j}}{p_{k'}} \right), \\ &= ASE(K) + AMSEOH(K). \end{aligned}$$

Partitioning of $\hat{AMSE}$ into ASE and AMSEOH enables an analysis of the potential trade-offs between ASE and AMSEOH as cost systems are modified by disaggregating cost pools.

We illustrate equation (14) by augmenting our example. We assume that the errors in the measurement of total setup and total machining costs are distributed randomly at their respective cost pools, each with mean zero, variance $(\$1,200)^2$, and covariance $-(\$1,200)^2$. Under these assumptions AMSEOH equals \$97,344 when the firm computes product costs using the CS1 system. In section III, we computed the average squared error (ASE) due to aggregation and misspecification in the CS1 system to be \$10,000. The average mean squared error in product costs $\hat{AMSE}$ in equation (14) totals \$107,344 ($\$10,000 + \$97,344$).

This example illustrates that the accuracy of a costing system can be affected if there are errors in the measurement of overhead costs at cost pools. However, the important issue is how AMSEOH will change as costing systems are modified to reduce specification and aggregation errors in product costs. Proposition 2 identifies conditions under which reducing aggregation and specification errors will systematically cause errors due to measurement errors in overhead cost pools to increase.

Proposition 2. (a) Under assumptions (4.1) through (4.3), and assuming that the proportional resource usage by products across cost pools have zero covariation, the average mean squared error due to measurement errors in overhead costs ($AMSEOH(K)$) *increases*

with a disaggregation of cost pools *iff* $\sigma_{k1}^2 V \left(\frac{p_{k1j}}{p_{k1}} \right) + \sigma_{k2}^2 V \left(\frac{p_{k2j}}{p_{k2}} \right) > \sigma_k^2 V \left(\frac{p_{kj}}{p_k} \right)$,

where $k1$ and $k2$ are cost pools formed by disaggregation of cost pool k , and σ^2 's and V 's represent the variance in measurement error in overhead costs and the variance in products' proportional resource usage at cost pools, respectively. Furthermore,

(b) If the variance in products' proportional resource usage at a cost pool increases with

a disaggregation of that cost pool, that is, $V \left(\frac{p_{kj}}{p_k} \right) \leq V \left(\frac{p_{k_h j}}{p_{k_h}} \right)$, $h = 1, 2$, where k_h 's are

cost pools formed by disaggregation of pool k , the average mean squared error due to

¹⁶ Details of underlying calculations can be found in the appendix.

measurement error in overhead costs (AMSEOH) will *increase monotonically* with greater disaggregation of cost pools.

The effect on product cost accuracy of measurement errors in overhead costs at the aggregate and disaggregate cost pools depends *both* on the measurement errors themselves and the weights attached to measurement errors at cost pools (the variances of products' relative resource usages). Proposition 2(a) indicates that disaggregation will result in higher AMSEOH, when the firm measures overhead costs at the aggregate level (k^{th} pool) fairly accurately ($\sigma_k^2 \equiv 0$) but significant errors exist in measuring the overhead costs at the disaggregate cost pools ($\sigma_{k_1}^2, \sigma_{k_2}^2 > 0$). This is the direct effect of measurement errors: greater measurement errors in overhead costs as a result of disaggregation increases errors in product costs. Proposition 2(b) describes a more subtle effect. It provides a sufficient condition for AMSEOH to increase monotonically with greater disaggregation in terms of the weights attached to the measurement errors. Note that this condition is independent of the magnitude of measurement error in overhead costs. That is, so long as there is some measurement error, greater diversity in resource usage by products at the disaggregate cost pools

$$\left(V \left(\frac{p_{kj}}{p_k} \right) \leq V \left(\frac{p_{k_h j}}{p_{k_h}} \right) \right)$$

will cause AMSEOH to increase monotonically. We argue below that greater disaggregation is likely to trigger this sufficient condition.

Firms disaggregate cost pools into more activity-specific cost pools with improved specification of cost allocation bases to reduce specification and aggregation errors. The improved mapping between allocation bases and products at the disaggregate level highlights the diversity in the products' relative use of resources which get obfuscated at the aggregate cost pool. This diversity in products' resource usages at the disaggregate cost pool level is likely to cause the variance in the products' relative resource usages (as measured by the cost allocation base) at the aggregate cost pool ($V(p_{kj}/p_k)$) to be less than the variance in the products' relative resource usages (as measured by cost allocation bases) at the disaggregate cost pools ($V(p_{k_h j}/p_{k_h})$). The condition described in Proposition 2(b) implies that the precise approaches aimed at reducing specification and aggregation errors could have the effect of increasing the variance in relative resource usages across products as a result of disaggregation, and hence, cause AMSEOH and ($\hat{AMSE}$) to increase. Our results suggest that accurate measurement of activity-specific costs becomes an important consideration when designing more refined cost systems. Otherwise, measurement errors in overhead costs could diminish any benefits from better specification and greater disaggregation.

V. Measurement Error in Units of Cost Allocation Bases

An important feature of cost system refinement is the shift to multiple and complex cost allocation bases. For example, instead of allocating all overhead costs using direct labor hours, refined cost systems create multiple cost pools each with its own allocation base such as setup hours and number of engineering changes. More complex allocation bases make measurement errors in the total units of cost allocation bases and in the units of cost allocation base assigned to each product more likely. As an example of problems in measuring units of cost allocation bases used by each product consider setup or clean out operations in chemical and paint plants. Setup time for a chemical depends on the sequence in which the firm produces chemicals. In paint shops, the clean out and setup time is a function of both the sequence of colors and the particular color being deployed. In such plants, it is very difficult to estimate the setup time specific to a particular chemical or paint color.

For analytical tractability, we assume zero error in measuring the total units of the cost allocation base at the cost pool level and focus on measurement errors in units of cost allocation base assigned to each product at a cost pool. We also assume zero measurement error in overhead costs. Consider the CS2 system in the example in section II. Suppose the firm correctly estimates the total number of machine hours across the two products but errs in estimating the machine hours specific to each product. The firm underestimates the machine hours for product A by 15 hours and overestimates the machine hours for product B by 15 hours. The costing system now allocates \$7,500 to product A resulting in a total error of \$1,000 which is higher than the error of \$625 in the cost of A in the absence of errors in measurement of product-specific machine hours.¹⁷

As in section IV, we extend the example in two ways. We model measurement error in the units of cost allocation bases identified to products by assuming measurement error to be a random variable with zero mean and some variance-covariance structure. Second, we use the average squared error metric to evaluate the effect of measurement error in the units of cost allocation bases across all products.

We define μ_{kj} as a random error in the measurement of the units of the cost allocation base (p_{kj}) specific to product j at cost pool k , and $\eta_{kj} = \frac{\mu_{kj}}{p_k}$ as the random proportion of error in p_{kj} with respect to the total units of allocation base at pool k . We make the following assumptions about μ_{kj} and η_{kj} .

(5.1) Total units of an allocation base at a cost pool are computed accurately without any measurement errors, i.e., $\sum_j (p_{kj} + \mu_{kj}) = \sum_j p_{kj} = p_k$, or, $\sum_j \mu_{kj} = 0$. (15)

(5.2) η_{kj} is distributed randomly across products with mean 0, variance $\sigma_{\eta k}^2$, and $\text{Cov}(\eta_{kj}, \eta_{kj'}) = \delta_{\eta_{kj}\eta_{kj'}} \forall j, j'$, and $k \in K$. (16)

(5.3) Errors in allocation units at a cost pool are distributed independently of errors in allocation units at other cost pools, the allocation units at each cost pool and the allocation units at each process,

$$\begin{aligned} E_j(\eta_{kj}\eta_{kj'}) &= 0 \quad \forall j, j' \text{ and } \forall k, k' \in K, k \neq k'; \\ E_j(\eta_{kj}p_{kj'}) &= 0; \text{ and } E_j(\eta_{kj}q_{ij'}) = 0 \quad \forall j, j' \text{ and } \forall i \in m, \text{ and } \forall k, k' \in K. \end{aligned} \quad (17)$$

The intuition behind assumption (5.2) is that the errors are not systematic or designed into the measurement of cost allocation units to products. Assumption (5.3) states that there are no systematic relations between errors in allocation units across cost pools, and that errors in measuring resources used by products are not related to the magnitude of resources used by products at any cost pool.

Under assumptions (5.1) through (5.3) the average mean squared error in product costs $\hat{AMSE}$ can be separated into (i) errors due to aggregation and misspecification (ASE), and (ii) errors due to inaccurate measurement of the units of allocation bases (AMSEU):¹⁸

$$\begin{aligned} \hat{AMSE}(K) &= \frac{1}{n} \sum_j E_j \left(\sum_i c_i q_{ij} - \sum_k \frac{OH_k}{p_k} (p_{kj} + \mu_{kj}) \right)^2, \\ &= \frac{1}{n} \sum_j \left(\sum_i c_i q_{ij} - \sum_k \frac{OH_k}{p_k} p_{kj} \right)^2 + \sum_k \sigma_{\eta k}^2 (OH_k)^2, \\ &= ASE(K) + AMSEU(K). \end{aligned} \quad (18)$$

¹⁷ The computations use the methodology described in panel C of table 2. The units of machine hours specific to products A and B are, however, different because of errors in measuring product-specific machine hours.

¹⁸ Details of underlying calculations can be found in the appendix.

Partitioning of $\hat{AMSE}$ allows an analysis of trade-offs between ASE and AMSEU as firms refine cost driver specifications and disaggregate cost pools.

We illustrate equation (18) by augmenting the example. Assume that in costing system CS2, the measurement error in product-specific machine hours is distributed randomly across products with mean 0, variance 0.002. Assume that there is no measurement error in the number of setups specific to individual products. Under these assumptions, AMSEU equals \$200,000 when product costs are computed using the CS2 system. In section III, the average squared error (ASE) due to aggregation and misspecification in the CS2 system was \$390,625. The average mean squared error ($\hat{AMSE}$) in the example now totals \$590,625 (\$390,625 + \$200,000).

The example illustrates that the accuracy of a costing system can be affected by errors in the measurement of product-specific units of cost allocation bases at cost pools. Again, the key question is whether the example can be generalized to provide an understanding of the behavior of AMSEU as firms modify costing systems to reduce specification and aggregation errors in product costs. Can AMSEU be contained as cost systems are refined? Are there necessary and sufficient conditions under which AMSEU increases? Such conditions would describe environments in which any benefits in product cost accuracy from greater disaggregation will be diminished by increases in measurement errors in the units of allocation bases. Proposition 3 formalizes a necessary and sufficient condition.

Proposition 3. Under assumptions (5.1) through (5.3), the average mean squared error due to measurement errors in the units of allocation bases ($AMSEU(K)$) *increases* with disaggregation of cost pools *iff*

$\sigma_{\eta_{k1}}^2 OH_{k1}^2 + \sigma_{\eta_{k2}}^2 OH_{k2}^2 > \sigma_{\eta_k}^2 OH_k^2$, where $k1$ and $k2$ are cost pools formed by disaggregation of cost pool k .

The goal of reducing specification and aggregation errors drives disaggregation of cost pools. The condition described in Proposition 3 weights the measurement errors in the product-specific units of allocation bases at the aggregate and disaggregate cost pools by the overhead costs at each cost pool. Proposition 3 and the illustrative example indicate that such disaggregations will result in higher AMSEU, when the units of allocation base at the aggregate level (k^{th} pool) are measured fairly accurately ($\sigma_{\eta_k}^2 \approx 0$) but significant error is introduced in measuring the units of allocation bases at the disaggregate cost pools ($\sigma_{\eta_{k1}}^2, \sigma_{\eta_{k2}}^2 > 0$). The direct effect of greater measurement errors in the units of allocation bases at the disaggregate cost pools is an increase in product costing errors. However, the weights attached to the measurement errors in the condition described in Proposition 3 have a dampening effect which makes it more difficult for $\sigma_{\eta_{k1}}^2 OH_{k1}^2 + \sigma_{\eta_{k2}}^2 OH_{k2}^2$ to be greater than $\sigma_{\eta_k}^2 OH_k^2$.¹⁹ This effect reduces the impact of measurement errors on the accuracy of product costs when designing more refined cost systems. If, however, these measurement errors are large, any benefits from greater disaggregation and better specification could still be lost. Moreover, incorporating measurement error in the total units of the cost allocation base at the cost pool level is likely to further negatively impact product cost accuracy.

¹⁹ $OH_{k1} + OH_{k2} = OH_k$ so that both OH_{k1}^2 and OH_{k2}^2 are smaller than OH_k^2 . Even if the measurement errors in the units of allocation bases at the disaggregate cost pools ($\sigma_{\eta_{k1}}^2$ and $\sigma_{\eta_{k2}}^2$) increase, it may still be the case that $\sigma_{\eta_{k1}}^2 OH_{k1}^2 + \sigma_{\eta_{k2}}^2 OH_{k2}^2$ is less than $\sigma_{\eta_k}^2 OH_k^2$. This dampening effect will be the greatest if OH_k is equally divided into OH_{k1} and OH_{k2} .

VI. Conclusion

Actual costs are not known to firms, so new cost systems are implemented by identifying better cost drivers and increasing the number of cost pools under an implicit assumption that these refinements would improve the accuracy of product cost numbers. To evaluate this assumption, we model the total error in the cost of a product as the sum of the individual and interaction effects of specification error, aggregation error, errors in measurement of overhead costs and errors in measurement of product-specific units of allocation bases. Explicit recognition of potential trade-offs among the different sources of error show that we cannot formally demonstrate simple propositions that partial improvements in cost systems (more cost pools and better specifications) necessarily result in more accurate product costs.

In theory, costing systems can be designed such that specification and aggregation errors will be minimal (or zero). Firms, however, must trade off the benefits of better specification and greater disaggregation with the costs of increased measurement errors in both overhead costs and in allocation units. These measurement errors have received little attention in the product costing literature. The implied trade-offs between the different kinds of errors become even more apparent when practical considerations enter into system designs. Because of transaction and implementation costs, multiple cost pool and multiple cost allocation based systems do not precisely capture the diversity and complexity of activities that give rise to costs. As a result, although these more detailed systems often reduce specification and aggregation errors, they may not always do so if the individual specification and aggregation errors in product costs in the more aggregate costing system offset each other.

Propositions 1, 2 and 3 yield insights into designing multiple cost pool and multiple cost allocation-based systems to reduce errors in product costs. For example, firms can reduce specification and aggregation error by better specifying and disaggregating cost pools that have the largest potential for error (rather than refining the largest cost pools). Measurement errors in overhead costs tend to increase product cost errors as firms refine cost systems. Hence, firms should focus on improving measures of overhead costs. On the other hand, measurement errors in product-specific units of allocation bases do not impact product cost accuracy nearly so strongly because of the smaller weights placed on errors at the disaggregate cost pools.

Firms should exercise care when refining overhead cost categories, such as general and administrative expenses, rents or taxes, that cannot be precisely associated with the overhead resources demanded by individual products. Often, identifying the appropriate activities that cause costs to arise is a difficult task; at other times, although activities and the cost of activities can be identified, the mapping from activities to products is unclear. In the context of our model, these are overhead cost categories for which a multiple cost pool and multiple cost allocation-based system will not reduce specification and aggregation errors. If measurement errors also simultaneously increase, implementing a more refined cost system will generally produce less accurate product costs. Since these measurement errors are also not directly observable to firms, future research might explore methods of estimating the parameters that would affect the design of effective costing systems.

Appendix Proof of Proposition 1

Proof considers three different cases depending on the relative ranges of the TE_j^1 and TE_j^2 errors. In each case, we compute probability (P) corresponding to four subcases depending on the signs and the relative sizes of the two errors. Specifically,

- (i) $TE_j^1 < 0, TE_j^2 > 0, |TE_j^1| > |TE_j^2|$, and $|TE_j^1 + TE_j^2| < |TE_j^2|$, as in Observation 1(B);
- (ii) $TE_j^1 > 0, TE_j^2 < 0, |TE_j^1| > |TE_j^2|$, and $|TE_j^1 + TE_j^2| < |TE_j^2|$, as in Observation 1(B);
- (iii) $TE_j^1 > 0, TE_j^2 < 0, |TE_j^1| < |TE_j^2|$, and hence $|TE_j^1 + TE_j^2| < |TE_j^2|$, as in Observation 1(C);
- (iv) $TE_j^1 < 0, TE_j^2 > 0, |TE_j^1| < |TE_j^2|$, and hence $|TE_j^1 + TE_j^2| < |TE_j^2|$, as in Observation 1(C).

Case 1: $a \leq b$

$$\begin{aligned}
 \text{(i)} \quad & P\left(TE_j^1 < 0, TE_j^2 > 0, |TE_j^1| > |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) = \frac{1}{4ab} \int_{-\frac{1}{2}TE_j^1}^0 \int_{-\frac{1}{2}TE_j^1}^{-TE_j^1} dTE_j^2 dTE_j^1 = \frac{a}{16b}; \\
 \text{(ii)} \quad & P\left(TE_j^1 > 0, TE_j^2 < 0, |TE_j^1| > |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) = \frac{1}{4ab} \int_0^a \int_{-TE_j^1}^{-\frac{1}{2}TE_j^1} dTE_j^2 dTE_j^1 = \frac{a}{16b}; \\
 \text{(iii)} \quad & P\left(TE_j^1 < 0, TE_j^2 > 0, |TE_j^1| < |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) = \frac{1}{4ab} \int_{-a}^0 \int_{-TE_j^1}^b dTE_j^2 dTE_j^1 = \frac{2b-a}{8b}; \\
 \text{(iv)} \quad & P\left(TE_j^1 > 0, TE_j^2 < 0, |TE_j^1| < |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) = \frac{1}{4ab} \int_0^a \int_{-b}^{-TE_j^1} dTE_j^2 dTE_j^1 = \frac{2b-a}{8b}; \\
 & \therefore P\left(TE_j^1 \leq 0 \geq TE_j^2 \text{ and } |TE_j^1 + TE_j^2| < |TE_j^1| + |TE_j^2| \text{ for } TE_j^1 = 0\right) = \frac{4b-a}{8b}.
 \end{aligned}$$

Case 2: $b \leq a \leq 2b$

$$\begin{aligned}
 \text{(i)} \quad & P\left(TE_j^1 < 0, TE_j^2 > 0, |TE_j^1| > |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) \\
 & = \frac{1}{4ab} \int_{\frac{a}{2}}^b \int_{-a}^{-TE_j^2} dTE_j^1 dTE_j^2 + \frac{1}{4ab} \int_0^{\frac{a}{2}} \int_{-2TE_j^2}^{-TE_j^2} dTE_j^1 dTE_j^2 = \frac{1}{4} - \frac{b}{8a} - \frac{a}{16b}; \\
 \text{(ii)} \quad & P\left(TE_j^1 > 0, TE_j^2 < 0, |TE_j^1| > |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) \\
 & = \frac{1}{4ab} \int_{-\frac{a}{2}}^a \int_{-b-TE_j^2}^{-TE_j^2} dTE_j^1 dTE_j^2 + \frac{1}{4ab} \int_{-\frac{a}{2}}^0 \int_{-TE_j^2}^{-2TE_j^2} dTE_j^1 dTE_j^2 = \frac{1}{4} - \frac{b}{8a} - \frac{a}{16b}; \\
 \text{(iii)} \quad & P\left(TE_j^1 < 0, TE_j^2 > 0, |TE_j^1| < |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) \\
 & = \frac{1}{4ab} \int_0^b \int_{-TE_j^2}^0 dTE_j^1 dTE_j^2 = \frac{b}{8a}; \\
 \text{(iv)} \quad & P\left(TE_j^1 > 0, TE_j^2 < 0, |TE_j^1| < |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) \\
 & = \frac{1}{4ab} \int_{-b}^0 \int_0^{-TE_j^2} dTE_j^1 dTE_j^2 = \frac{b}{8a}; \\
 & \therefore P\left(TE_j^1 \leq 0 \geq TE_j^2 \text{ and } |TE_j^1 + TE_j^2| < |TE_j^1| + |TE_j^2| \text{ for } TE_j^1 = 0\right) = \frac{4b-a}{8b}.
 \end{aligned}$$

Case 3: $a \geq 2b$

$$\begin{aligned}
 \text{(i)} \quad & P\left(TE_j^1 < 0, TE_j^2 > 0, |TE_j^1| > |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) = \frac{1}{4ab} \int_0^b \int_{-2TE_j^2}^{-TE_j^2} dTE_j^1 dTE_j^2 = \frac{b}{8a}; \\
 \text{(ii)} \quad & P\left(TE_j^1 > 0, TE_j^2 < 0, |TE_j^1| > |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) = \frac{1}{4ab} \int_{-b}^0 \int_{-TE_j^2}^{-2TE_j^2} dTE_j^1 dTE_j^2 = \frac{b}{8a}; \\
 \text{(iii)} \quad & P\left(TE_j^1 < 0, TE_j^2 > 0, |TE_j^1| < |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) = \frac{1}{4ab} \int_0^b \int_{-TE_j^2}^0 dTE_j^1 dTE_j^2 = \frac{b}{8a}; \\
 \text{(iv)} \quad & P\left(TE_j^1 > 0, TE_j^2 < 0, |TE_j^1| < |TE_j^2|, |TE_j^1 + TE_j^2| < |TE_j^2|\right) = \frac{1}{4ab} \int_{-b}^0 \int_0^{-TE_j^2} dTE_j^1 dTE_j^2 = \frac{b}{8a}; \\
 \therefore & P\left(TE_j^1 \leq 0 \geq TE_j^2 \text{ and } |TE_j^1 + TE_j^2| < |TE_j^1| + TE_j^2 \text{ for } TE_j^1 = 0\right) = \frac{b}{2a}.
 \end{aligned}$$

Derivation of Equation (14)

$$AM\hat{SE}(K) = \frac{1}{n} \sum_j E \left(\sum_i c_i q_{ij} - \sum_k \frac{(OH_k + e_k)}{p_k} p_{kj} \right)^2,$$

where the expectation operator E represents expectations over the joint distributions of measurement errors in overhead costs across all K cost pools,

$$= \frac{1}{n} \sum_j E \left(\sum_k \sum_{i \in k} \frac{C_i}{q_i} q_{ij} - \sum_k \frac{(OH_k + e_k)}{p_k} p_{kj} \right)^2,$$

Let $q_{ij} / q_i = v_{ij}$ and $p_{kj} / p_k = u_{kj}$, then

$$\begin{aligned}
 AM\hat{SE}(K) &= \frac{1}{n} \sum_j E \left(\sum_k \sum_{i \in k} v_{ij} C_i - \sum_k u_{kj} (OH_k + e_k) \right)^2, \\
 &= \frac{1}{n} \sum_j \left(\sum_k \sum_{i \in k} v_{ij} C_i - \sum_k u_{kj} OH_k \right)^2 + \frac{1}{n} \sum_j E \left(\sum_k u_{kj} e_k \right)^2,
 \end{aligned}$$

where cross product terms are zero from assumption (4.3),

$$\begin{aligned}
 &= \frac{1}{n} \sum_j \left(\sum_k \sum_{i \in k} v_{ij} C_i - \sum_k u_{kj} OH_k \right)^2 + \sum_k \sum_{k'} \delta_{kk'} \frac{1}{n} \sum_j (u_{kj} \cdot u_{k'j}) \forall k, k', \\
 &= ASE(K) + AMSEOH(K).
 \end{aligned}$$

(a1)

Proof of Proposition 2

(a) We focus on the AMSEOH(K):

$$\text{AMSEOH}(K) = \sum_k \sum_{k'} \delta_{kk'} \frac{1}{n} \sum_j (u_{kj} \cdot u_{k'j}) \quad \forall k, k',$$

$$= \sum_k \sigma_k^2 \frac{1}{n} \sum_j (u_{kj}^2) + \sum_k \sum_{k', k' \neq k} \delta_{kk'} \left(\frac{1}{n} \sum_j (u_{kj}) \frac{1}{n} \sum_j (u_{k'j}) \right),$$

under the assumption of zero covariation between proportional resource usage by products across cost pools,²⁰

$$= \left[\sum_k \sigma_k^2 \frac{1}{n} \sum_j (u_{kj}^2) - \sum_k \sigma_k^2 \frac{1}{n} \sum_j (u_{kj}) \frac{1}{n} \sum_j (u_{kj}) \right] \\ + \left[\sum_k \sum_{k', k' \neq k} \delta_{kk'} \left(\frac{1}{n} \sum_j (u_{kj}) \frac{1}{n} \sum_j (u_{k'j}) \right) + \sum_k \sigma_k^2 \frac{1}{n} \sum_j (u_{kj}) \frac{1}{n} \sum_j (u_{kj}) \right],$$

$$= \sum_k \sigma_k^2 V(u_{kj}) + \sum_k \sum_{k'} \delta_{kk'} \left(\frac{1}{n} \sum_j (u_{kj}) \frac{1}{n} \sum_j (u_{k'j}) \right),$$

where $V(u_{kj})$ is the variance of u_{kj} across products at pool k ,

$$= \sum_k \sigma_k^2 V(u_{kj}) + \frac{1}{n^2} \sum_k \sum_{k'} \delta_{kk'}, \text{ since } \sum_j u_{kj} = 1, \quad \forall k, \quad \frac{1}{n} \sum_j (u_{kj}) = \frac{1}{n},$$

but, from assumption (4.1),

$$\sum_k \sum_{k'} \delta_{kk'} = \sum_k \sum_{k'} \text{Cov}(e_k, e_{k'}) = \sum_k \text{Cov}(e_k, \sum_{k'} e_{k'}) = \sum_k \text{Cov}(e_k, 0) = 0,$$

$$\Rightarrow \text{AMSEOH}(K) = \sum_{k=1}^K \sigma_k^2 V(u_{kj}). \quad (\text{a2})$$

without loss of generality, suppose cost pool k is disaggregated into two cost pool k_1 and k_2 , leading to a total of $K+1$ cost pools.

$$\text{AMSEOH}(K+1) - \text{AMSEOH}(K)$$

$$= \sum_{k=1}^{K+1} \sigma_k^2 V(u_{kj}) - \sum_{k=1}^K \sigma_k^2 V(u_{kj}),$$

$$= \sigma_{k_1}^2 V(u_{k_1j}) + \sigma_{k_2}^2 V(u_{k_2j}) - \sigma_k^2 V(u_{kj}). \quad (\text{a3})$$

$$\Rightarrow \text{AMSEOH}(K+1) > \text{AMSEOH}(K) \Leftrightarrow \sigma_{k_1}^2 V(u_{k_1j}) + \sigma_{k_2}^2 V(u_{k_2j}) > \sigma_k^2 V(u_{kj}).$$

²⁰The monotonicity of increases in AMSEOH may not hold in cases when cost allocation bases at disaggregate cost pools are finer partitions of the allocation bases at the aggregate pools. In such cases we cannot assume zero covariance between proportional resource usage by products across different cost pools due to the fact that the total units of the cost allocation base assigned to each product is fixed. However, finer partition of the same cost allocation base at disaggregated cost pools goes against the basic objective of improvements in specification with disaggregation. This objective is satisfied, in part, by defining activity-specific cost pools each with a distinct allocation base proxying for drivers of costs in the cost pool.

(b) Suppose $V(u_{kj}) \leq V(u_{k_hj})$, $h = 1, 2$,

then $AMSEOH(K+1) - AMSEOH(K)$

$$\begin{aligned} &\geq \sigma_{k1}^2 V(u_{kj}) + \sigma_{k2}^2 V(u_{kj}) - \sigma_k^2 V(u_{kj}), \\ &= V(u_{kj}) [\sigma_{k1}^2 + \sigma_{k2}^2] - \sigma_k^2 V(u_{kj}), \\ &> V(u_{kj}) [\sigma_{k1}^2 + 2\delta_{k1k2} + \sigma_{k2}^2] - \sigma_k^2 V(u_{kj}), \\ &\quad \text{since } e_{k1} + e_{k2} = e_k; \text{Cov}(e_{k1}, e_{k2}) = \delta_{k1k2} < 0, \\ &= \sigma_k^2 V(u_{kj}) - \sigma_k^2 V(u_{kj}) = 0, \text{ since } \sigma_{k1}^2 + 2\delta_{k1k2} + \sigma_{k2}^2 = \sigma_k^2. \end{aligned}$$

That is, $AMSEOH(K+1) - AMSEOH(K) > 0$, or $AMSEOH$ increases monotonically with disaggregation of cost pools.

Derivation of Equation (18)

$$AM\hat{S}E(K) = \frac{1}{n} \sum_j E_j \left(\sum_i c_i q_{ij} - \sum_k \frac{OH_k}{p_k} (p_{kj} + \mu_{kj}) \right)^2,$$

where the expectation operator E_j represents expectation over the joint distribution of measurement error in allocation units across all K cost pools for product j .

Let $q_{ij} / q_i = v_{ij}$, $p_{kj} / p_k = u_{kj}$ and using $\eta_{kj} = \mu_{kj} / p_k$, we have

$$\begin{aligned} AM\hat{S}E(K) &= \frac{1}{n} \sum_j \left(\sum_k \sum_{i \in k} v_{ij} C_i - \sum_k (u_{kj} + \eta_{kj}) OH_k \right)^2, \\ &= \frac{1}{n} \sum_j \left(\sum_k \sum_{i \in k} v_{ij} C_i - \sum_k u_{kj} OH_k \right)^2 + \frac{1}{n} \sum_j E_j \left(\sum_k \eta_{kj} OH_k \right)^2, \end{aligned}$$

where cross product terms are zero from assumption (5.3),

$$= \frac{1}{n} \sum_j \left(\sum_k \sum_{i \in k} v_{ij} C_i - \sum_k u_{kj} OH_k \right)^2 + \sum_k \left(\frac{1}{n} \sum_j E_j (\eta_{kj} OH_k)^2 \right),$$

where cross product terms are zero from assumption (5.3),

$$= \frac{1}{n} \sum_j \left(\sum_k \sum_{i \in k} v_{ij} C_i - \sum_k u_{kj} OH_k \right)^2 + \sum_k \sigma_{\eta_k}^2 (OH_k)^2, \quad (a4)$$

= since $E_j(\eta_{kj}) = 0$ from assumption (5.2),

$$AM\hat{S}E(K) = ASE(K) + AMSEU(K).$$

Proof of Proposition 3

We focus on the AMSEU(K).

Without loss of generality consider a case when cost pool k is disaggregated into two cost pools k1 and k2, leading to a total of K+1 cost pools. The AMSEU at the K+1 cost pool system is given as:

$$\text{AMSEU}(K+1) = \sum_{k=1}^{K+1} \sigma^2_{\eta_k} (\text{OH}_k)^2 \quad (\text{a5})$$

$$\begin{aligned} \text{AMSEU}(K+1) - \text{AMSEU}(K) &= \sum_{k=1}^{K+1} \sigma^2_{\eta_k} (\text{OH}_k)^2 - \sum_{k=1}^K \sigma^2_{\eta_k} (\text{OH}_k)^2, \\ &= \sigma^2_{\eta_{k1}} (\text{OH}_{k1})^2 + \sigma^2_{\eta_{k2}} (\text{OH}_{k2})^2 - \sigma^2_{\eta_k} (\text{OH}_k)^2. \end{aligned}$$

Therefore,

$$\text{AMSEU}(K+1) > \text{AMSEU}(K) \Leftrightarrow \sigma^2_{\eta_{k1}} (\text{OH}_{k1})^2 + \sigma^2_{\eta_{k2}} (\text{OH}_{k2})^2 > \sigma^2_{\eta_k} (\text{OH}_k)^2.$$

References

- Aigner, D. J., and S. M. Goldfeld. 1974. Estimation and prediction from aggregate data when aggregates are measured more accurately than their components. *Econometrica* 42: 113–134.
- Alles, M., and S. Datar. 1993. Strategic costing, allocating fixed costs when pricing, transfer pricing and activity based costing. Working Paper, Stanford University, Stanford, CA.
- Banker, R., and G. Potter. 1993. Economic comparison of single cost driver and activity-based costing systems. *Journal of Management Accounting Research* 5: 15–32.
- Cooper, R. 1988. The rise of activity-based costing - part two: When do I need an activity-based cost system? *Journal of Cost Management* 1 (Fall): 41–48.
- . 1989. The rise of activity-based costing - part three: How many cost drivers do you need, and how do you select them? *Journal of Cost Management* 2 (Winter): 34–46.
- , and P. B. B. Turney. 1990. Internally focused activity-based cost systems. In *Measures of Manufacturing Excellence*, edited by R. S. Kaplan. Boston: Harvard Business School Press.
- , R. S. Kaplan, L. S. Maisel, E. Morrissey, and R. M. Oehm. 1992. *Implementing Activity-Based Cost Management: Moving from Analysis to Action*. Montvale, NJ: Institute of Management Accountants.
- Dewan, R. M., and R. P. Magee. 1992. Product costing systems: Information economics and implementation. Working Paper, Northwestern University, Evanston, IL.
- Foster, G., and M. Gupta. 1990a. Manufacturing overhead cost driver analysis. *Journal of Accounting and Economics* 12: 309–337.
- , and ———. 1990b. Activity accounting: An electronic industry implementation. In *Measures of Manufacturing Excellence*, edited by R. S. Kaplan. Boston: Harvard Business School Press.
- Grunfeld, Y., and Z. Griliches. 1960. Is aggregation necessarily bad? *The Review of Economics and Statistics* 42: 1–13.
- Gupta, M. 1993. Heterogeneity issues in aggregated product costing systems. *Journal of Management Accounting Research* 5: 180–212.
- Hwang, Y., J. H. Evans III, and V. G. Hegde. 1993. Product cost bias and selection of an allocation base. *Journal of Management Accounting Research* 5: 213–242.
- Ijiri, Y. 1975. *Theories in Accounting Measurement*. Studies in Accounting Research (10). Sarasota, FL: AAA.
- John Deere Component Works. 1989. Case # 9-187-107/8. Boston: Harvard Business School Press.
- Lim, S. S., and S. Sunder. 1990. Accuracy of linear valuation rules in industry segmented environments:

- Industry vs. economy-weighted indexes. *Journal of Accounting and Economics* 13: 167–189.
- , and ———. 1991. Efficiency of asset valuation rules under price movement and measurement errors. *The Accounting Review* 66: 669–693.
- Merchant, K., and M. Shields. 1993. When or why to measure costs less accurately to improve decision making. *Accounting Horizons* 7(2): 76–81.
- Siemen's Electric Motor Works. 1989. Case # 9-189-089. Boston, MA: Harvard Business School Press.
- Vives, X. 1990. Trade association disclosure rules, incentives to share information, and welfare. *RAND Journal of Economics* 21: 409–430.
- Zimmerman, J. 1979. The costs and benefits of cost allocations. *The Accounting Review* 54: 504–521.

Audit Pricing, Lowballing and Auditor Turnover: A Dynamic Analysis

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SYNOPSIS AND INTRODUCTION: Regulatory bodies that oversee the provision of audit services have recently expressed concern about the common practice of pricing initial audits significantly below cost (lowballing). Specifically, it is feared that lowballing could weaken auditor independence and reduce audit quality, since lowballing could provide clients with a credible threat of terminating incumbent auditors should they refuse accounting concessions. However, Magee and Tseng (1990) have shown that when auditors possess all bargaining power and there is no disagreement among auditors on the proper interpretation of GAAP, clients have nothing to gain by threatening termination of incumbent auditors and there is no weakening of auditor independence. Therefore, the concern expressed by regulators must presuppose that clients (i) possess bargaining power superior to that of auditors, and (ii) are free to change auditors at any time. But, if these features are true, it is puzzling why lowballing would occur in the first place. Lowballing can only occur if there are rents to be earned by auditors (DeAngelo 1981a), but such rents seem to be inconsistent with clients possessing most of the bargaining power (Dye 1991; Magee and Tseng 1990).

We construct and analyze an economic model of audit pricing which shows how equilibrium audit prices would sustain rents and lowballing even when clients have most or all of the bargaining power and are free to change auditors every period. Our analysis also throws light on the related phenomenon of auditor turnover, and shows that the efficient pricing of audit services by itself precipitates some turnover apart from any turnover due to other forces such as client-auditor disagreements (Dye

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1991) and client-auditor matching (Gigler and Penno 1993). Given auditor turnover, we analyze how audit prices, lowballing, and turnover rates evolve over time.

Key Words: *Lowballing, Auditor turnover, Information asymmetry.*

THE principal assumptions used in our analysis are: (1) clients have bargaining power that is superior to auditors, at least in setting audit prices, (2) audit contracts are signed only one period at a time, (3) an incumbent auditor acquires private client specific information about the recurring cost of auditing that client, and (4) it is costly for a client to replace an incumbent auditor. Given these assumptions, we show how rents, lowballing and auditor turnover occur as equilibrium phenomena and how each plays an important role in the efficient pricing of audit services. In spite of the client's superior bargaining position, the informational advantage of an incumbent auditor (together with the transaction costs of replacement) results in a stream of client specific rents that accrues *every* period. Being fully cognizant of the informational advantage of an incumbent auditor, the client seeks to limit these rents by using the power of competition in the market for auditors. We show that the client's optimal exploitation of this competition results in auditor turnover, and that the optimal pricing mechanism can be interpreted as take-it-or-leave-it price offers by the client. We identify conditions under which lowballing would be larger and auditor turnover rates smaller for large clients than for small clients.

In a multi-period model, the dynamics of audit prices, lowballing and auditor switches produces a sequence of take-it-or-leave-it price offers, with each succeeding offer incorporating the information learned by the client from previous audit engagements. Under specific distributional assumptions, we find that an incumbent auditor faces a take-it-or-leave-it offer only once during his or her tenure. An incumbent who survives this offer remains an incumbent in all future periods. Further, the next auditor is rarely replaced; there is a non-zero probability of replacement only when transaction costs are relatively small. Thus, auditor turnover becomes less likely over time. We characterize the extent of lowballing by succeeding auditors and find that the lowball of the succeeding auditor exceeds that of the previous auditor. However, excluding the effect of the initial lowball, audit fees generally increase when an auditor is replaced.

The rest of the paper is organized as follows. Section I contains a description and analysis of a static model that illustrates the basic economic forces determining equilibrium audit prices and related phenomena. Section II studies dynamics by extending the analysis to a multi-period setting. Section III derives empirical implications, and Section IV concludes with a discussion of related audit issues and alternative assumptions. We also provide here a brief discussion of the implications of our analysis for the issues of client pressure and auditor independence. Proofs of all propositions are contained in the appendix.

I. A Static Model

Consider a situation where a client firm expects to be in business for two periods. During each of these periods the firm issues financial statements that must be audited.¹ There exist many potential auditors, with identical audit technologies, who compete for the firm's audit business. As in DeAngelo (1981a), we assume that there are client-specific start up costs associated with initial audits and costs associated with switching auditors. The cost of an initial audit for a specific

¹ We do not address the issue of why audits have value or why they are mandatory. See Baiman et al. (1987), Melumad and Thoman (1990) and Dye (1991) for an analysis of how audits acquire value in moral hazard and adverse selection environments.

client is $K+c$, while the cost of a repeat audit by the same auditor for the same client is c . Additionally, the client firm bears a transaction cost of S every time it switches auditors.

Contrary to DeAngelo, we make the following assumptions. (i) The client has all the bargaining power, rather than the auditor, (ii) the client signs contracts with auditors for only one period at a time, and (iii) in the process of conducting an audit the auditor acquires private information on the recurring cost c of auditing the client.

Assumption (i) implies that the client can specify the pricing mechanism. The assumption that clients have literally *all* the bargaining power is a useful abstraction, given recent deregulation and increased competition among auditors. Our objective in making this assumption is to demonstrate that lowballing is robust to bargaining power assumptions.

Assumption (ii) says that clients are unable to make binding long term commitments regarding the future retention of incumbent auditors or future audit prices. Such binding long-term commitments appear to be rare in practice, probably because of prohibitions on audit contracts that are contingent on the content of audit reports. In the absence of contingent commitments, a client's right to change auditors would serve as an important disciplining device.² In the analysis to follow we indicate the effect of relaxing this assumption.

In assumption (iii) we postulate that initially the client and all potential auditors know only the range in which audit costs could lie and assess a common prior distribution over this range. After doing an initial audit, an incumbent auditor privately learns the precise cost of auditing his client. Competing auditors and the client can only update their beliefs based on limited observable events. This information asymmetry is the main force underlying our analysis; so it is important to examine its realism. DeAngelo (1981b) cites the Cohen Commission Report on Auditors' Responsibilities: "mandatory auditor rotation would considerably increase the cost of audits because of the frequent duplication of the *start up and learning time necessary to gain familiarity with the company*" (emphasis added). Start up costs arise due to a need to study the client firm's business, the organization of its operations, and its internal control system. Audits are not standardized products. The scope and efficient design of an audit consistent with GAAS requires detailed client-specific information, much of which is discovered by an auditor in the process of conducting the initial audit for the specific client. Thus, non-incumbent auditors would not know the precise extent of auditing that is needed and, therefore, the cost of conducting the audit.

Let $F(c)$ be the prior distribution of audit costs assessed by all parties in period 1, before any audits have been carried out. We assume that $F(\cdot)$ has support $[a, b]$ with strictly positive density $f(\cdot)$ and strictly increasing inverse hazard rate $F(c)/f(c)$ over this interval.³ The transaction costs K and S are known constants. All parties are assumed to be risk neutral. An auditor is chosen for the first audit in period 1 via competitive bids with all parties symmetrically informed. After conducting the audit in period 1, the incumbent auditor learns the precise value of c , and therefore possesses an informational advantage in period 2.

An equilibrium is constructed by working backwards from period 2. The client's main concern in designing a mechanism for period 2 is to exploit the fact that the incumbent auditor knows the precise cost of conducting the audit and, at the same time, to use market competition to limit the incumbent's informational rents. It seems intuitive that the client would request a cost quotation from the incumbent auditor while threatening replacement if the quotation is too high.⁴

² A sketch of a model of such an environment is available on request from the authors.

³ This assumption, commonly made in the incentives literature, is satisfied by many familiar distributions such as the normal, uniform, exponential and gamma distributions.

⁴ Such breakout rules have also been studied in Riordan and Sappington (1989) and Laffont and Tirole (1988b).

More formally, since the client can make one period commitments, the optimal allocation for period 2 can be derived via the Revelation Principle.

A revelation mechanism for period 2 is a triple of functions on $[a, b]$:

$x(c)$ = the probability that the incumbent auditor is retained,

$p(c)$ = price paid for the incumbent auditor's services, and

$q(c)$ = price offered to competing non-incumbent auditors.

The replacement of an incumbent auditor is a publicly observable event. Therefore, non-incumbent auditors will update their beliefs regarding audit cost whenever the client shops for a new auditor. Let:

R = The event that an incumbent auditor is replaced.

$f(c|R)$ = The Bayesian posterior density on $[a, b]$.

Given a replacement policy, $1 - x(c)$, this posterior density is calculated as follows:

$$f(c|R) = \frac{[1 - x(c)]f(c)}{\int_a^b [1 - x(t)]f(t)dt} \quad (1)$$

An optimal revelation mechanism for period 2, $\{x(c), p(c), q(c)\}$, must solve:

$$\text{Min} \int_a^b \{x(c)p(c) + [1 - x(c)][q(c) + S]\}f(c)dc \quad (2)$$

subject to :

$$x(c)[p(c) - c] \geq x(c')[p(c') - c], \forall c, c' \quad (3)$$

$$x(c)[p(c) - c] \geq 0, \forall c \quad (4)$$

$$\int_a^b [q(c) - c - K]f(c|R)dc \geq 0 \quad (5)$$

The inequalities (3) are a continuum of incentive constraints, requiring that the mechanism induces truth-telling by the incumbent auditor. Constraints (4) and (5) are participation constraints, requiring non-negative profits for incumbent and non-incumbent auditors, respectively, conditional on what each agent knows. The solution to this programming problem is characterized in Proposition 1 below.

Proposition 1:

There exists a unique $p^* \in [a, b]$ such that the optimal allocations for period 2 are characterized by:

$$x(c) = \begin{cases} 1 & \text{if } c \leq p^* \\ 0 & \text{otherwise} \end{cases} \quad (6)$$

$$p(c) = \begin{cases} p^* & \text{if } c \leq p^* \\ 0 & \text{otherwise} \end{cases} \quad (7)$$

$$q(c) = K + E(c | c \geq p^*) \quad (8)$$

$$\frac{F(p^*)}{f(p^*)} = K + S \quad (9)$$

If there is no interior solution to this last equation, then $p^* = b$.

The revelation mechanism, derived above, formally requires the incumbent auditor to send a cost message to the client, who responds according to precommitted price and replacement rules. However, the same allocations can be implemented by the following simpler but completely equivalent institutional arrangement. The client makes a take-it-or-leave-it price offer of p^* to the incumbent auditor. The latter accepts this offer if the audit cost is less than p^* , and rejects it otherwise. If rejection occurs, the client goes to the market to hire a new auditor.⁵ Non-incumbent auditors update their beliefs and obtain the audit contract at their expected cost, conditional on the evidence that cost exceeds p^* .

Given period 2 equilibrium allocations, the period 1 equilibrium price and the lowball can be calculated. In period 1 there is no incumbent, so competition among auditors will result in an equilibrium price equal to the expected first period cost of auditing less expected rent accruing to the incumbent in period 2. Thus the magnitude of lowballing is:

$$\text{low ball} = \int_a^{p^*} (p^* - c) f(c) dc = p^* F(p^*) - \int_a^{p^*} c f(c) dc \quad (10)$$

Integrating the last term by parts and canceling common terms yields:

$$\text{low ball} = \int_a^{p^*} \left(\frac{F(c)}{f(c)} \right) f(c) dc \quad (11)$$

Since p^* is increasing in $(K+S)$, it follows from (11) that the magnitude of the low ball is increasing with the transaction costs of replacing an incumbent auditor.

In DeAngelo's model, there is perfect and symmetric information on audit costs and the predicted lowball is $(K + S)$. In our model, the magnitude of the lowball is strictly smaller, since

$$\frac{F(c)}{f(c)} < K + S, \quad \forall c < p^*.$$

This result, though true for a two period model, may change when additional periods are added. In this case DeAngelo's model would continue to predict a lowball of $K+S$, but lowballing would increase in our model since the auditor's rents would accumulate over periods.

The above analysis also sheds some light on the relative effects of bargaining power and information asymmetry on the magnitude of lowballing. When all bargaining power is with the client and there is no information asymmetry regarding audit costs, there are no rents and no lowballing. When information asymmetry is introduced, rents and lowballing appear, but they are not as high as when all bargaining power is with the auditor.

Auditor turnover emerges endogenously in our analysis and plays a crucial role in the efficient pricing of audit services. Given information asymmetry regarding audit costs, take-it-or-leave-it offers and attendant auditor turnover are an efficient way to exploit market competition to squeeze the incumbent auditor's informational advantage. If (11) has an interior solution, i.e., $p^* < b$ (which henceforth will be assumed), then auditor turnover occurs whenever audit costs lie in the interval $[p^*, b]$. From (9) it is clear that p^* is strictly increasing in $(K+S)$. *Ceteris paribus*, this implies that auditor turnover rates would be smaller for those firms that have higher auditor start up and switching costs.

⁵ The mechanism is not renegotiation proof. It is important that the client commits to not renegotiate the price offer of p^* .

DeAngelo (1981b) cites empirical evidence that auditor turnover rates are higher for small clients than for large clients. It is likely that the costs of changing auditors $K+S$ are increasing in client size. However, the inverse hazard rate F/f is also crucial to the determination of auditor turnover rates, and it is difficult to assess how this hazard rate would change systematically with client size. For example, one might conjecture that the distribution of audit costs would have a larger variance for larger clients, but the general effect of larger variances on hazard rates is unclear. Consequently, without additional specification, it is difficult to predict how auditor turnover rates would vary with client size in our model. In the example below, we assume a uniform distribution on audit costs and derive conditions under which auditor turnover would be negatively correlated with client size.

The Case of the Uniform Distribution

Assume that c has a uniform distribution on $[a, b]$. For this distribution the inverse hazard rate is $\frac{F(c)}{f(c)} = c - a$, and from (9):

$$p^* = \begin{cases} a + K + S & \text{if } K + S < b - a \\ b & \text{if } K + S \geq b - a \end{cases}$$

Hereafter we assume that $K + S < b - a$, so that p^* is interior. The probability of observing auditor turnover is $1 - F(p^*) = 1 - \frac{K + S}{b - a}$. Thus, if audit costs are uniformly distributed and if big

firms have transaction costs that are larger *relative* to the range in which audit costs could lie, then auditor turnover rates would be negatively correlated with client size. The magnitude of the low ball observed in the period 1 audit price can be calculated from (11).

$$\text{low ball} = \frac{1}{b - a} \int_a^{p^*} (c - a) dc = \frac{1}{b - a} \frac{(K + S)^2}{2}.$$

Thus, under the conditions described above, lowballing would increase in a convex way with transaction costs. This is because both p^* and the probability of retaining the incumbent are increasing in $K+S$.

The above analysis assumes that audit contracts can only be signed one period at a time. If the client could make binding long term commitments, there would still be lowballing for initial audit engagements but auditor turnover would disappear. The client would optimally commit in period 1 to a period 2 price of $p^* = b$. There is no ex ante cost to the client from such a high price commitment, since all of the expected auditor rent would be lowballed away. The benefit to such a commitment is that auditor turnover costs would be reduced to zero.

II. Evolution of Audit Prices and Auditor Turnover

Several important questions can only be addressed by studying the dynamics of audit pricing. Do future period effects result in a substantial reduction in the initial take-it-or-leave-it price offer, in view of the fact that an accepted low offer would yield cost savings over several future periods rather than just one period? Would client firms make take-it-or-leave-it offers *every* period? Do auditor turnover rates grow, remain steady, or decay over time? How does the magnitude of lowballing change over time as auditors are replaced? The answers to these questions could provide additional testable implications for the model.

To obtain insight into the dynamic issues described above, we extend our analysis to a three period model.⁶ We continue to assume that clients can commit to audit contracts for only one period at a time, and that an incumbent auditor cannot commit to stay with the firm in future periods. Given these assumptions, future audit contracts would be negotiated in the light of information revealed from past audits, and the anticipation of future negotiations would affect the terms at which current audit contracts are offered.

In this setting, an equilibrium would consist of message strategies for incumbent auditors, probabilities of retaining incumbent auditors contingent on past and current messages, and prices offered to incumbent and non-incumbent auditors contingent on past and current messages. In period one, all competing auditors and the client share the same information; consequently no messages are sent. An auditor (A1) is hired via a competitive bidding process. In period two, A1 privately knows the audit cost and sends a message, not necessarily truthful, regarding audit cost to the client who responds in accordance with precommitted retention probabilities and prices. The outcome of this interaction is that A1 is either retained or dismissed and replaced by a non-incumbent auditor A2. All parties update their beliefs regarding audit costs, in the light of what they have observed in period two. In period three, the current incumbent (either A1 or A2) sends a new message regarding audit cost. This new message results in the retention or dismissal of the current incumbent in accordance with preannounced retention and price strategies which are optimal relative to the client's beliefs at the beginning of period three.

The above sequence of strategies and beliefs must constitute a Bayesian equilibrium in the following sense.

(i) The client's third period commitments to retention probabilities and prices and the incumbent auditor's third period message strategy are best responses to each other, given the client's beliefs at the beginning of period three. The nature of equilibrium in this subgame is similar to that described for the final period of the two period game in section 1.

(ii) The client's beliefs in period three are consistent, (in the Bayesian sense), with the equilibrium message strategies of auditors in period two.

(iii) The client's commitments in period two are optimal taking into account both period two outcomes and period three *equilibrium* outcomes.

(iv) Auditor A1's message strategy in period two maximizes expected profits over periods two and three, taking into account the effect of his or her message on the equilibrium that results in period three.

(v) The prices offered each period must be such that an auditor accepts it and makes non-negative expected profits in that period conditional on his or her information in that period.

Given our assumptions on the infeasibility of multi-period commitments, Proposition 2 establishes that there is no incentive scheme which would induce an incumbent auditor to fully reveal the cost of audit to the client in period 2. This implies that the Revelation Principle cannot be used to characterize the equilibrium allocations in the multi-period situation to be analyzed.

Proposition 2: There is no sequentially rational pair of audit contracts that induces an incumbent auditor to fully reveal the true audit cost in the second period.

The forces driving this result are exactly the same as in Gibbons (1987), Baron and Besanko (1987), and Laffont and Tirole (1988a), who establish similar results in different contexts. If an

⁶ In principle, one would prefer steady-state results that are independent of the number of periods over which audits are required. However, the analysis becomes increasingly complex as additional periods are added. We believe that the basic forces present in a three period model would also be present over a longer horizon, and the qualitative results we derive would continue to hold.

incumbent auditor revealed the true audit cost to the client in period 2, the client would price the period 3 audit contract at cost, reducing the auditor's profit to zero in period 3. Given this equilibrium for period 3, in order to induce truthful revelation in period 2, the client would have to price the period 2 audit so that the incumbent auditor receives enough rent in period 2 to offset the rents that would otherwise have been received over periods 2 and 3 combined. This forces the rents associated with low cost declarations to become so large that high cost auditors do better by pretending that costs are low, making excessive profits in period 2, then abandoning the client in period 3. The assumption that auditors cannot bind themselves to servicing the client in future periods is crucial to this argument. (Alternative commitment assumptions are discussed in Section IV).

When the Revelation Principle cannot be used, it is generally very difficult to characterize the set of all Bayesian equilibria of all communication games that can be derived from the multi-period client-auditor relationship. Thus it is difficult to determine the globally optimal allocations. However, in the two period game analyzed earlier, the globally optimal allocations were implementable by a take-it-or-leave-it pricing mechanism, and sequences of take-it-or-leave-it price offers would seem to be the natural multi-period analog of the optimal two period mechanism. Therefore, in the analysis to follow, we restrict attention to this class of pricing mechanisms where each subsequent offer by the client incorporates the information revealed by previous interchanges, and each current offer anticipates future equilibria.

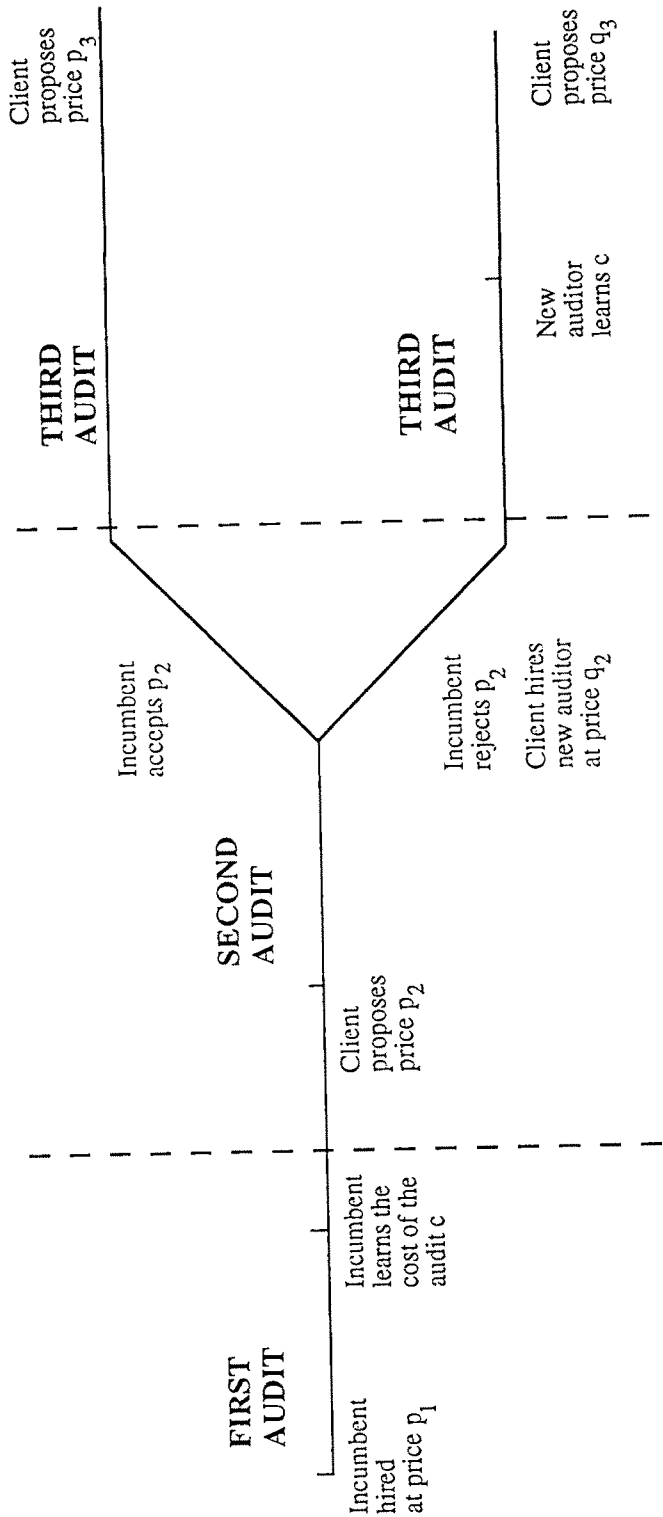
Such mechanisms have the following form. In period 1, auditor A1 is hired at a price p_1 . In period 2 the client offers A1 a take-it-or-leave-it price offer of p_2 . A1 accepts the offer if $c \leq p_2$ and rejects it otherwise. If A1 accepts this offer, the client makes a new take-it-or-leave-it offer of p_3 in the third period knowing that $c \leq p_2$. If this period 3 offer is rejected by A1, the client seeks an auditor in the market⁷ where competing auditors bid with the knowledge that $p_3 < c \leq p_2$. On the other hand, if A1 rejects the period 2 offer, the client and all non-incumbent auditors update their beliefs conditional on the information that $c > p_2$. The client then hires a new auditor A2, who lowballs in the light of his updated beliefs and in anticipation of the period 3 equilibrium. The resultant price will be called q_2 . (To keep track of the notation, note that p 's represent offers to A1, q 's represent offers to A2, and subscripts indicate the audit period for which the offer is made). Next, in period 3, the client offers A2 a price of q_3 taking into account the information that $c > p_2$. If A2 rejects this offer, competing auditors bid with the knowledge that $c > q_3$. Finally, the offer of p_2 made to A1 in period 2 anticipates the information revealed by A1's acceptance or rejection of this offer and the effect of this information on the period 3 equilibrium offers. The time line in Figure 1 summarizes this sequence of events.

We proceed to derive the optimal mechanism from the class of mechanisms described above. It is convenient to work backwards, beginning with period 3. At the start of period 3, p_2 is a given parameter and either A1 or A2 is the incumbent auditor. If A1 is the incumbent auditor, A1 must have accepted the client's price offer in the previous period, so the information available to the client is that $c \leq p_2$. The client now chooses a new price offer of $p_3 \leq p_2$ to minimize the expected period 3 audit cost. The risk that the client faces in trying to cut the audit price further is that if p_3 is rejected the audit price rises to $[K + S + E(c|p_3 \leq c \leq p_2)]$, which is generally bigger than p_2 . The probability that the new offer will be accepted is $\frac{F(p_3)}{F(p_2)}$. The tradeoff faced here by the client

is exactly the same as in the static model of Section I, except that the distribution of c is truncated above at p_2 . Since hazard rates are invariant to upward truncations of a distribution, the optimal choice of p_3 is characterized by:

⁷ We assume that once an auditor is dismissed he is no longer eligible to audit the client.

Figure 1
Timeline



Lemma 3⁸: If $p_2 > H^{-1}(K+S)$ then $p_3 = H^{-1}(K+S)$, where $H(c) \equiv \frac{F(c)}{f(c)}$, and
 If $p_2 \leq H^{-1}(K+S)$ then $p_3 = p_2$.

If, on the other hand, A2 is the incumbent auditor in period 3, then A1 must have rejected the client's price offer in period 2, so the client knows that $c \geq p_2$. Additionally A2 will have learned the true audit cost from the audit he conducted in period 2. The client now chooses an audit price q_3 for period 3, knowing that if the offered price is rejected the new audit price will become $[K+S+E(c|c \geq q_3)]$. The client also takes into account that the probability of q_3 being accepted is $\frac{F(q_3) - F(p_2)}{1 - F(p_2)}$. Analysis of the client's pricing problem yields:

Lemma 4: The optimal value of q_3 satisfies $q_3 > H^{-1}(K+S)$, $\forall p_2 > a$. If $q_3 < b$ then q_3 is a strictly increasing function of p_2 .

Lemmas 3 and 4 indicate that while $p_3 \leq H^{-1}(K+S)$, $q_3 > H^{-1}(K+S)$ for all possible period 2 prices because the information available to the client is different in the two cases. The choice of p_3 is conditioned by the knowledge that $c \leq p_2$, while q_3 is chosen with the knowledge that $c > p_2$. The optimal pricing strategy reflects the client's search for the true audit cost. However, search is costly since it results in auditor turnover. Thus when p_2 is sufficiently small, the knowledge that $c \leq p_2$ precludes further search implying $p_3 = p_2$. The value $p^* = H^{-1}(K+S)$ is the optimal audit price in a one period search, as shown in the static model of Section I. This price reflects the appropriate balance between search costs and benefits when the search is over the entire support of the distribution of audit costs. However, when it is known that $c > p_2$ the distribution is truncated below, so optimally $q_3 > p^*$. The bigger the value of p_2 , the bigger must be the value of q_3 .

These lemmas complete our analysis of the period 3 equilibrium, contingent on the information revealed in period 2. We now turn to the analysis of the client's optimal pricing strategy in period 2.

If A1 is dismissed in period 2, competing auditors and the client infer that $c > p_2$. Competition in the market for auditors will result in a period 2 price that incorporates this information and which reflects lowballing by A2 in anticipation of period 3 rents. Specifically,

$$A2's \text{ lowball} = \text{Prob}(c \leq q_3 | c \geq p_2) E(q_3 - c | p_2 \leq c \leq q_3)$$

$$= \frac{1}{1 - F(p_2)} \int_{p_2}^{q_3} (q_3 - c) f(c) dc$$

In equilibrium, A2 bids his expected cost less this lowball. Thus,

$$q_2 = K + \frac{1}{1 - F(p_2)} \left[\int_{p_2}^b c f(c) dc - \int_{p_2}^{q_3} (q_3 - c) f(c) dc \right] \quad (12)$$

The above analysis implies that all audit prices in period 3, as well as the price bid by nonincumbents in period 2, depend crucially upon the initial price offer of p_2 made to the first incumbent auditor. The value of p_2 determines the information content of the first incumbent's response to this price offer. The optimal value of p_2 is determined by minimizing the client's expected cost of audits over both periods 2 and 3, taking into account the effect that p_2 has on all subsequent audit prices. Thus p_2 must be a solution to:

⁸ Lemmas 1 and 2 are contained in the appendix.

$$\begin{aligned} \text{Min}_{p_2} \quad & F(p_2) [p_2 + p_3 \text{Prob}(c \leq p_3 | c \leq p_2) + \{K+S+E(c|p_3 \leq c \leq p_2)\} \text{Prob}(c \geq p_3 | c \leq p_2)] \\ & + [1 - F(p_2)] [S + q_2 + q_3 \text{Prob}(c \leq q_3 | c \geq p_2) + \{K+S+E(c|c \geq q_3)\} \text{Prob}(c \geq q_3 | c \geq p_2)] \end{aligned} \quad (13)$$

In the above expression p_3 , q_3 , and q_2 are functions of p_2 as described in Lemma 3, Lemma 4, and (12) respectively. The term multiplying $F(p_2)$, in (13), is the client's expected cost over two periods if auditor A1 accepts the client's period 2 offer, and the term multiplying $[1-F(p_2)]$ is the expected cost if A1 rejects this offer and is replaced by A2. Inserting probability calculations, the equilibrium value of q_2 derived in (12), and simplifying yields the equivalent program:

$$\begin{aligned} \text{Min}_{p_2} \quad & p_2 F(p_2) + p_3 F(p_3) + [2 - F(p_3) - F(q_3)] [K+S] \\ & + \int_{p_3}^{p_2} cf(c)dc + 2 \int_{p_2}^b cf(c)dc \end{aligned} \quad (14)$$

Differentiating (14) with respect to p_2 and canceling common terms yields the first order condition that characterizes the optimal value of p_2 ,

$$F(p_2) + F(p_3) \frac{dp_3}{dp_2} - [K+S] [f(p_3) \frac{dp_3}{dp_2} + f(q_3) \frac{dq_3}{dp_2}] = 0 \quad (15)$$

To understand (15) we show that there are two opposing forces that are traded off in determining p_2 . The first of these forces tends to decrease p_2 below p^* , which is the optimal period 2 price in the static model of Section I. The benefit from decreasing p_2 is that if this lower price is accepted by the incumbent auditor the client obtains the lower price in two periods rather than a single period. To see this, modify (15) by holding q_3 fixed and inserting $p_3 = p_2$. In this case (15) implies $p_2 = H^{-1}[(1/2)(K+S)] < p^*$. This force is offset by the fact that q_3 is an increasing function of p_2 . When p_2 is reduced q_3 is also reduced which, in turn, increases the probability of auditor turnover and its attendant transaction costs in period 3. The net effect on p_2 depends on how sensitive the sequentially rational choice of q_3 is with respect to p_2 . If q_3 is not very sensitive to p_2 then the benefits to decreasing p_2 more than offset the costs, so $p_2 < H^{-1}(K+S)$. Conversely, when q_3 is sufficiently sensitive to changes in p_2 then optimally $p_2 > H^{-1}(K+S)$. Analysis of (15) yields:

Proposition 3: If the optimal value of $q_3 < b$, then:

$$\begin{aligned} p_3 &= p_2 = H^{-1}(K+S) \text{ if } f'(c) = 0 \quad \forall c > H^{-1}(K+S), \\ p_3 &= p_2 < H^{-1}(K+S) \text{ if } f'(c) < 0 \quad \forall c > H^{-1}(K+S), \\ p_3 &= H^{-1}(K+S) < p_2 \text{ if } f'(c) > 0 \quad \forall c > H^{-1}(K+S), \end{aligned}$$

In general, it is impossible to obtain closed-form expressions for period 3 prices as a function of the period 2 price p_2 . The value of q_3 and the sensitivity of q_3 with respect to p_2 depends in some complex way on the size of $(K+S)$ and the shape and support of the density function. This implies that in a dynamic setting, the evolution of equilibrium audit prices, lowballing and auditor turnover will be distribution specific and the relevant properties of the distribution cannot be summarized solely in terms of hazard rates. To obtain additional insight into these pricing and turnover phenomena, we examine a particular class of distributions.

The Case of the Uniform Distribution

Assume that audit cost is uniformly distributed over the interval $[a, b]$. For this distribution the hazard rate is $H(c) = c - a$, and $H^{-1}(K+S) = a+K+S$. This linear structure permits precise calculations yielding:

Proposition 4: If audit cost, c , is uniformly distributed over the interval $[a, b]$ then equilibrium audit prices are:

- (i) $p_3 = p_2 = a+K+S$, and $q_3 = a+2(K+S)$, if $(K+S)/(b-a) < 1/2$
- (ii) $p_3 = p_2 = b-(K+S)$, and $q_3 = b$, if $1/2 \leq (K+S)/(b-a) < 2/3$
- (iii) $p_3 = p_2 = a+(1/2)(K+S)$, and $q_3 = b$, if $(K+S)/(b-a) \geq 2/3$

Proposition 4 shows that, in the case of the uniform distribution, the interaction between transaction costs and the uncertainty in audit costs is conveniently summarized in the ratio $(K+S)/(b-a)$. It is the *relative* size of transaction costs to the range of possible audit costs that determines the evolution of audit prices, auditor turnover and lowballing. Figure 2 displays how audit prices vary with transaction costs in each of the three relevant intervals identified in Proposition 4.

The intuition underlying the results in Proposition 4 is as follows. For the uniform distribution, when $q_3 < b$, $dq_3/dp_2 = 1$ implying that the benefit to reducing period 2's price is *exactly* offset by the cost of an increase in auditor turnover in period 3. Consequently, the period 2 audit price is unaffected by dynamic considerations, and $p_2 = H^{-1}(K+S)$, as in the static case. This is result (i) in Proposition 4. However, when transaction costs are sufficiently large relative to the range of possible audit costs, $(K+S \geq 2/3(b-a))$, it is too costly for the client to risk additional auditor turnover in period 3. The sequentially rational choice in period 3 is to price the audit at the largest possible audit cost, i.e. $q_3 = b$. In this case, variations in p_2 have no effect on q_3 (the price offered the second incumbent auditor in period 3) and the period 2 price is lowered to squeeze the first incumbent auditor over each of two periods, yielding (iii) of Proposition 4. In the intermediate case (ii), if p_2 is chosen equal to $H^{-1}[1/2(K+S)]$, the sequentially rational choice of q_3 is less than b . The client now has an incentive to increase both second and third period prices so as to save on the transaction costs of auditor turnover. Therefore, the second period price is increased just enough to make $q_3 = b$ sequentially rational.

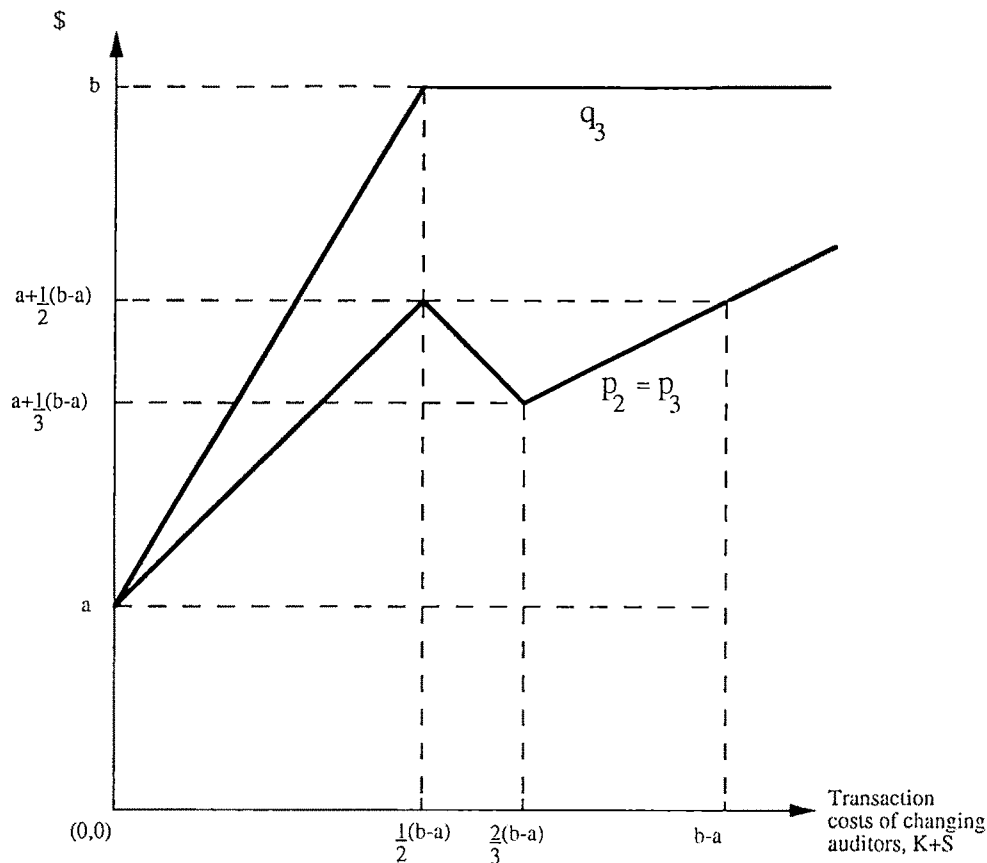
III. Empirical Implications

In this section we describe the dynamics of auditor turnover and lowballing that are implied by the equilibrium pricing strategies characterized in Propositions 3 and 4. Recall that these propositions have been derived for a three period model, and additionally Proposition 4 uses the assumption of uniformly distributed audit costs. Therefore the implications discussed below are specific to these assumptions.

Implications for Auditor Turnover:

Proposition 4 shows that, when audit costs are uniformly distributed, $p_3 = p_2$ regardless of the relative size of transaction costs. This implies that the first incumbent auditor faces a take-it-or-leave-it price offer at most once during his or her tenure. If this offer is accepted, there is no auditor turnover and audit prices stay the same in all future periods. If the first auditor is replaced, the succeeding auditor faces a take-it-or-leave-it offer in period 3 only if transaction costs are relatively small [$K+S < (1/2)(b-a)$]. In this case, turnover could occur in both periods 2 and 3, but the probability of turnover in period 3 [$1-F(q_3)$] is smaller than in period 2 [$1-F(p_2)$]. In all other cases, the succeeding auditor never confronts take-it-or-leave-it offers and there is no further

Figure 2
Relationship between audit prices and transaction costs when audit costs are uniformly distributed on [a, b]



p_2 = Audit price offered to the first auditor in period 2.
 p_3 = Audit price offered to the first auditor in period 3 if p_2 is accepted in period 2.
 q_3 = Audit price offered to the second auditor in period 3 if p_2 is rejected by the first auditor in period 2.

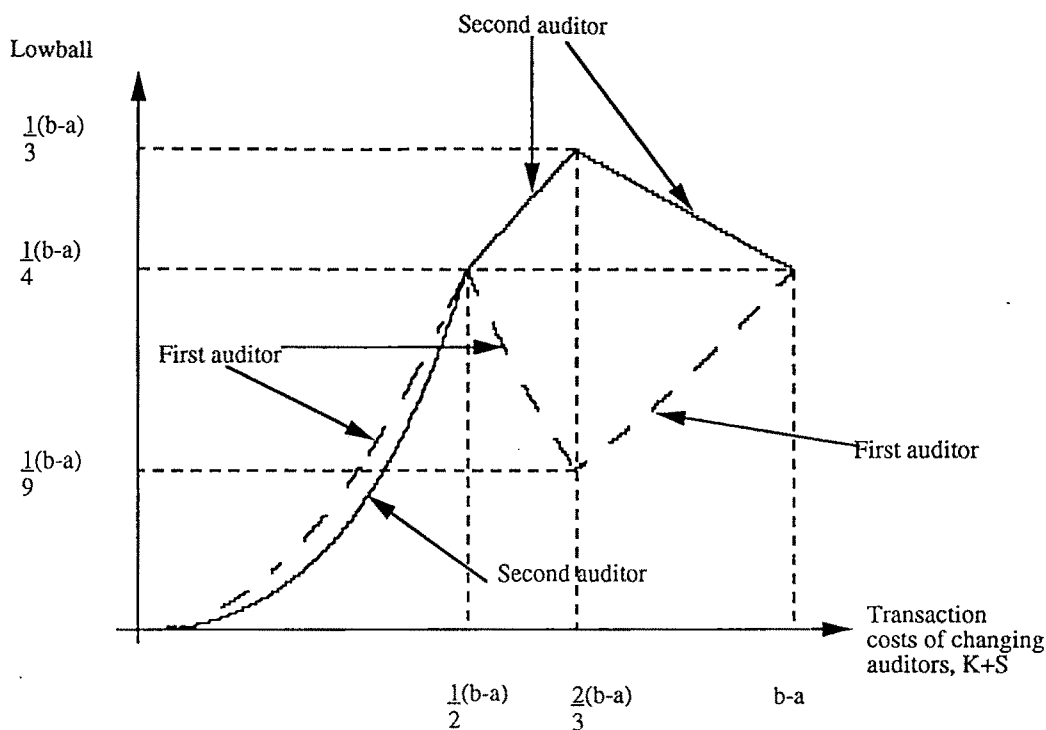
auditor turnover. Thus, in the case of the uniform distribution, auditor turnover becomes less likely over time. (Proposition 3 shows that these results are also true for any density function which is non-increasing in the region $c \geq H^{-1}(K+S)$).

Implications for Lowballing

Lowballing occurs each time a new auditor is hired. In the case of the uniform distribution, the precise magnitude of lowballing in periods 1 and 2 can be calculated and compared. Since $p_3 = p_2$, A1's lowball in period 1 = $2 \text{ Prob}(c \leq p_2) E[p_2 - c | c \leq p_2]$, while A2's lowball in period 2 = $\text{Prob}(c \leq q_3 | c \geq p_2) E[q_3 - c | p_2 \leq c \leq q_3]$. Using the equilibrium prices described in Proposition 4 to calculate these amounts, yields:

Proposition 5: Assume that audit costs are uniformly distributed over the interval [a,b]. If $K+S < 1/2 (b-a)$ A1's lowball exceeds A2's lowball. If $K+S > 1/2 (b-a)$ A2's lowball exceeds A1's lowball.

Figure 3
Lowballing by successive auditors in relation to transaction costs when audit costs are uniformly distributed on $[a, b]$



Note that A1 has the opportunity to earn rents over two periods while A2 has the opportunity to earn rents over only one period. In spite of this, A2's lowball is larger than A1's lowball when transaction costs are sufficiently large. If we adjust for the difference in the number of time periods, (to better reflect situations in which there is no arbitrary last period), A2's lowball is always larger. Thus an empirical implication of our model is that when an incumbent auditor is replaced, the magnitude of lowballing increases. This result is due to two forces. First, for incentive reasons p_2 is biased downwards, decreasing A1's rent and increasing the probability of his replacement. Second, the range of possible audit costs, $(b - p_2)$, for auditor A2 is strictly smaller than the range $(b - a)$ for auditor A1, making the conditional probability of A2's replacement strictly smaller than the unconditional probability of A1's replacement.

Figure 3 displays how lowballing varies with the magnitude of transaction costs for each of the two auditors.

The relationship between lowballing and transaction costs is not monotonic. The value of p_2 is greatest when $K+S = (1/2)(b-a)$, so A1's lowball peaks at this point. To the right of this point A2's lowball is not monotonic even though the equilibrium audit price for period 3 remains fixed at b . This result occurs because the period 2 price offered to A1 continues to vary with transaction costs, affecting the assessment of period 3 rent to be earned by A2.

IV. Conclusion

Our analysis assumes that clients can commit only to single period price offers, and that neither clients nor auditors can bind themselves to continue the relationship beyond a single audit engagement. If these assumptions were relaxed to allow full inter-temporal commitments by the client, then the optimal multi-period mechanism would repeat the optimal static mechanism each period (Baron and Besanko 1984). In this case, equilibrium audit prices would be b each period, where b is the highest possible audit cost. This pricing rule is optimal because all anticipated rents would be lowballed away, and transaction costs would be reduced to zero. Thus, with full inter-temporal commitment, lowballing would increase but auditor turnover would disappear.

An alternative commitment assumption (fair mechanisms), studied in Baron and Besanko (1987), would constrain auditors to stay with clients while allowing clients to change auditors at the end of any period. Thus, if a high cost auditor claimed to be a low cost type, he or she would be constrained to stay with the client as long as the audit price is sufficient to cover the cost of a low cost auditor. In this case, our Proposition 2 would no longer hold. Under the best “fully revealing fair mechanism,” the auditor would earn a large rent in the first period, but no rents thereafter since future prices would be set at true marginal cost. However, the first period rent in the fair mechanism case exceeds the cumulative rents in the full commitment case. This implies that lowballing would be even greater under fair mechanisms than under full commitment mechanisms, but auditor turnover would disappear once again.

Our model does not explicitly incorporate reporting and auditor independence issues, so there are no formal results on whether lowballing *per se* would produce client pressure on the quality of audit reports. However, in our analysis of lowballing the amount of rents earned by the auditor are not visible to the client, since the client never discovers the true cost of the auditor. Given this lack of knowledge, the client does not know the extent of damage the auditor would incur if his or her services were terminated. In addition, we show that the incumbent auditor's value of retaining the client is lower when the bargaining power resides with the client rather than the auditor. Therefore client pressure is a less serious problem than it would be if lowballing arises from the kind of forces modeled in DeAngelo (1981a).

In Dye (1991), auditor turnover occurs due to disagreement with the client on the content of the report to outside parties. Rents and lowballing arise because, given the legal liability assumed in Dye, clients have an incentive to overpay auditors to induce attestation to more favorable reports. In contrast, we have shown that lowballing and auditor turnover could arise solely due to efficient pricing concerns, even in the absence of such attestation pressures. However, both approaches emphasize that some kind of information asymmetry is necessary for rents and lowballing to be sustainable as equilibrium phenomena when clients have superior bargaining power.

The results described in this paper are not restricted to auditing but would apply to any industry which had the following characteristics. (i) Goods or services are specific to each individual client's idiosyncratic needs. (ii) Information about a specific client's needs is discovered mainly during the process of servicing the client. (iii) Client specific information is useful for repeatedly servicing the client in the future. (iv) Long term contingent contracts cannot be written. (v) There are several competing suppliers. The audit industry fits these characteristics very well. Lowballing is also a common phenomenon in the consulting business and in the advertising agency business which share many of the above characteristics. Even though repeat engagements in these industries are not identical to previous engagements, the client-specific information that is privately available to an incumbent is rather important for servicing the client, and this endows the incumbent with a considerable advantage over competing suppliers of the same service.

Appendix

Proposition 1 relies on two lemmas which are stated and proved below. Let $U(c)$ be the incumbent auditor's expected payoff when he or she communicates truthfully and $U^*(c', c)$ be the expected payoff when the true cost c is represented as c' , i.e.

$$U(c) = x(c)[p(c) - c], \quad (A1)$$

$$U^*(c', c) = x(c') [p(c') - c] \quad (A2)$$

Lemma 1: A mechanism $\{x(c), p(c), q(c)\}$ satisfies (3) and (4) if and only if:

$$U(c) = U(b) + \int_c^b x(t)dt, \quad (A3)$$

$$x(c) \text{ is non-increasing, and} \quad (A4)$$

$$U(b) \geq 0 \quad (A5)$$

Proof of Lemma 1

We first prove the necessity part of the lemma. From (A1) and (A2),

$$U^*(c', c) - U(c') = x(c') [c' - c] \quad (A6)$$

Incentive compatibility requires $U(c) \geq U^*(c', c)$, i.e.,

$$U(c) \geq U(c') + x(c') [c' - c] \quad (A7)$$

Similarly, the incentive compatibility constraint $U(c') \geq U^*(c, c')$ reduces to,

$$U(c') \geq U(c) + x(c) [c - c'] \quad (A8)$$

Combining (A7) and (A8), incentive compatibility implies,

$$x(c') [c' - c] \leq U(c) - U(c') \leq x(c) [c - c'] \quad (A9)$$

From (A9), it is clear that $x(c)$ is nonincreasing. In turn, this implies that $x(c)$ is continuous almost everywhere. Dividing (A9) by $c' - c$ and taking the limit as $c' \rightarrow c$ yields.

$$U'(c) = -x(c), \quad (A10)$$

which implies (A3).

Next we show that (A3) and (A4) imply (3), proving the sufficiency part of the lemma.

$$U(c) - U^*(c', c) = [U(c) - U(c')] - [U^*(c', c) - U(c')]$$

$$= \int_c^{c'} x(t)dt - x(c')[c' - c], \text{ from (A10) and (A6)}$$

$$= \int_c^{c'} [x(t) - x(c')] dt$$

This last expression is non-negative from (A4), proving that (3) is satisfied. Finally, since $x(t)$ is non-negative for each t , (A3) implies $U(c) \geq U(b)$, $\forall c$. Therefore (A5) implies (4). ■

Lemma 2: If $\{x(c), p(c), q(c)\}$ is an optimal mechanism then $x(c)$ must be a solution to,

$$\text{Min} \int_a^b \left\{ x(c) \left[c + \frac{F(c)}{f(c)} \right] + [1 - x(c)] [c + K + S] \right\} f(c) dc \quad (\text{A11})$$

Proof of Lemma 2

From the definition of $U(c)$ and (A3) it follows that

$$x(c) p(c) = c x(c) + \int_a^b x(t) dt + U(b) \quad (\text{A12})$$

Taking an expectation over audit costs yields:

$$\begin{aligned} \int_a^b x(c) p(c) f(c) dc &= \int_a^b c x(c) f(c) dc + \int_a^b \int_a^b x(t) dt f(c) dc + U(b) \\ &= \int_a^b x(c) \left[c + \frac{F(c)}{f(c)} \right] f(c) dc + U(b) \end{aligned} \quad (\text{A13})$$

Constraint (5) is obviously binding, otherwise $q(c)$ could be decreased by some constant without affecting any other constraint. Using (1), constraint (5) can be rewritten:

$$\int_a^b q(c) [1 - x(c)] f(c) dc = \int_a^b [c + K] [1 - x(c)] f(c) dc. \quad (\text{A14})$$

Since the incentive constraints (3) can be replaced by (A13) and (A4), the participation constraints (4) can be replaced by (A5) and constraint (5) can be replaced by (A14), the programming problem can be rewritten as:

$$\begin{aligned} \text{Min}_{x(c), U(b)} \quad & \int_a^b \left\{ x(c) \left[c + \frac{F(c)}{f(c)} \right] + [1 - x(c)] [c + K + S] \right\} f(c) dc \\ & + U(b) \end{aligned} \quad (\text{A15})$$

Subject to : $U(b) \geq 0$

If the solution to (A11) satisfies (7), then this solution can be used to characterize the optimal mechanism. ■

Proof of Proposition 1

The first order conditions to (A15) imply $U(b) = 0$ and

$$x(c) = \begin{cases} 1 & \text{if } \frac{F(c)}{f(c)} \leq K + S \\ 0 & \text{otherwise} \end{cases}$$

Given our assumption that the inverse hazard rate $\frac{F(c)}{f(c)}$ is strictly increasing, $x(c)$ must satisfy (6), where p^* satisfies (9). Next $p(c)$ can be calculated from (A12). For $c \leq p^*$,

$$p(c) = c + \int_c^b x(t) dt = c + \int_c^{p^*} dt = p^*$$

Also, from (A12), $p(c) = 0$ for $c > p^*$. Finally, from (A14)

$$\int_{p^*}^b q(c) f(c) dc = \int_{p^*}^b (c + K) f(c) dc, \text{ which is satisfied by (8).}$$
■

Proof of Proposition 2

Let $x_t(\bullet)$, $t=2,3$, be the probabilities of retaining incumbent auditor A1 in periods 2 and 3 respectively. Let $p_t(\bullet)$, $t=2,3$, be the prices offered A1 in each of these periods. Suppose A1's message strategy in period 2 is to truthfully disclose audit costs. Then no new message is needed in period 3. Conditional on A1 being retained in period 2, the equilibrium audit contract in period 3 is:

$$p_3(\tilde{c}) = \tilde{c}, x_3(\tilde{c}) = 1, \forall \tilde{c},$$

where $\tilde{c}$ is A1's message in period 2. Now suppose that true audit cost is c and c' is any other cost $\in [a, b]$. Given the period 3 contracts described above, truthful revelation of audit cost in period 2 yields A1 total expected profits over periods 2 and 3 of:

$$U(c) = x_2(c) [p_2(c) - c].$$

If, instead, A1 reports c' the total expected profits are:

$$U^*(c', c) = x_2(c') [p_2(c') - c] + \max \{0, x_2(c') [c' - c]\}$$

This last expression incorporates the assumption that A1 can always quit the relationship in period 3 if period 3 profit is negative.

Let (c', c) be any feasible pair of audit costs with $c' > c$. Truth-telling is optimal for A1, in period 2, only if the period 2 contract satisfies:

$$x_2(c) [p_2(c) - c] \geq x_2(c') [p_2(c') - c] + x_2(c') [c' - c], \text{ and} \quad (\text{A16})$$

$$x_2(c') [p_2(c') - c'] \geq x_2(c) [p_2(c) - c'] \quad (\text{A17})$$

We will show that (A16) and (A17) are incompatible, in the sense that satisfaction of one implies violation of the other. Inequality (A16) is equivalent to:

$$x_2(c) [p_2(c) - c'] + x_2(c) [c' - c] \geq x_2(c') [p_2(c') - c'] + 2 x_2(c') [c' - c], \text{ i.e.,}$$

$$x_2(c) [p_2(c) - c'] \geq x_2(c') [p_2(c') - c'] + [2x_2(c') - x_2(c)] [c' - c]$$

Thus, (A17) can be satisfied only if,

$$x_2(c') \leq 1/2 x_2(c), \forall (c', c) \text{ such that } c' > c$$

This is impossible unless $x_2(\bullet) = 0$ almost everywhere. ■

Proof of Lemma 3

The client's problem is to choose $p_3 \leq p_2$ to solve:

$$\text{Min } p_3 \frac{F(p_3)}{F(p_2)} + \frac{1}{F(p_2)} \left[\int_{p_3}^{p_2} cf(c)dc + (K + S) (F(p_2) - F(p_3)) \right]$$

The first order condition to this problem is,

$$F(p_3) - f(p_3)[K+S] \leq 0, \text{ with equality if } p_3 < p_2, \text{ which implies the desired result.} \quad \blacksquare$$

Proof of Lemma 4

The client's problem is to choose $q_3 \geq p_2$ to solve:

$$\text{Min } q_3 [F(q_3) - F(p_2)] + \int_{q_3}^b cf(c)dc + (K + S) (1 - F(q_3)).$$

This yields the first order condition,

$$F(q_3) - f(q_3) (K+S) = F(p_2), \text{ if } q_3 < b \quad (\text{A18})$$

Since $F(p_2) > 0$ and $F(c) - f(c)[K+S] \leq 0 \forall c \leq H^{-1}(K+S)$, it follows from (A18) that $q_3 > H^{-1}(K+S)$.

To prove that q_3 is strictly increasing in p_2 it is sufficient to establish that $F(c) - f(c)[K+S]$ is strictly increasing in c in the interval $c > H^{-1}(K+S)$, i.e.,

$$f(c) - f'(c)[K+S] > 0, \forall c > H^{-1}(K+S). \quad (A19)$$

Now, $\frac{d}{dc} \frac{F(c)}{f(c)} > 0 \Rightarrow \frac{f'}{f} < \frac{f}{F'} \forall c$

Additionally, $\frac{F}{f} > K+S, \forall c > H^{-1}(K+S)$.

Therefore $\frac{f'}{f} < \frac{1}{K+S}, \forall c > H^{-1}(K+S)$ which is equivalent to (A19). It then follows from (A18) that q_3 is a strictly increasing function of p_2 . ■

Proof of Proposition 3

$$\text{From (A18), } \frac{dq_3}{dp_2} = \frac{f(p_2)}{f(q_3) - f'(q_3)(K+S)} > 0 \quad (A20)$$

Since the relationship between p_3 and p_2 depends upon whether $p_2 \leq H^{-1}(K+S)$ or $p_2 > H^{-1}(K+S)$, we investigate each of the two regions:

$p_2 \leq H^{-1}(K+S)$:

In this region $p_3 = p_2$ and $\frac{dp_3}{dp_2} = 1$. Therefore (14) becomes:

$$2F(p_2) = [K+S] [f(p_2) + f(q_3) \frac{dq_3}{dp_2}]$$

Substituting for $\frac{dq_3}{dp_2}$ from (A20) yields

$$\frac{F(p_2)}{f(p_2)} = \frac{1}{2} (K+S) \left[1 + \frac{f(q_3)}{f(q_3) - f'(q_3)(K+S)} \right]$$

from which it follows that,

$$f'(q_3) \begin{cases} = 0 \Rightarrow p_2 = H^{-1}(K+S) \\ < 0 \Rightarrow p_2 < H^{-1}(K+S) \\ > 0 \Rightarrow p_2 > H^{-1}(K+S) \end{cases} \quad (A21)$$

$$p_2 > H^{-1}(K+S)$$

In this region $p_3 = H^{-1}(K+S)$ and $\frac{dp_3}{dp_2} = 0$. Therefore (14) becomes:

$$\frac{F(p_2)}{f(p_2)} = (K+S) \left[\frac{f(q_3)}{f(q_3) - f'(q_3)(K+S)} \right]$$

which also yields (A21). Since $q_3 > H^{-1}(K+S)$, the desired result is proved. ■

Proof of Proposition 4

In the case of the uniform distribution (A18) implies:

$$\begin{aligned} p_2 < b - (K+S) &\Rightarrow q_3 = p_2 + K+S < b \\ p_2 \geq b - (K+S) &\Rightarrow q_3 = b \end{aligned} \quad (A22)$$

Since for the uniform distribution $f'(c) = 0 \ \forall c$, Proposition 3 implies that

$$p_3 = p_2 = H^{-1}(K+S) = a+K+S, \text{ when } q_3 < b.$$

From (A22), $p_2 = a+K+S \Rightarrow q_3 < b$ if $a+K+S < b - (K+S)$.

Thus, when $K+S < 1/2 (b-a)$, equilibrium audit prices are:

$$p_3 = p_2 = a+K+S, \quad q_3 = a + 2(K+S) < b, \text{ establishing (i) of Proposition 4.}$$

Now consider the case where $K+S \geq 1/2 (b-a)$. We will determine the optimal value of p_2 by examining the behavior of the objective function, described in (14), over various intervals in which p_2 could lie. First, consider the interval $p_2 > a+K+S$. Lemma 3 implies that for every value of p_2 in this interval the optimal value of $p_3 = a+K+S$, and $\frac{dp_3}{dp_2} = 0$. Also, $K+S \geq 1/2 (b-a) \Rightarrow a+K+S \geq b - (K+S)$. Therefore, from (A22),

$$p_2 > a+K+S \Rightarrow q_3 = b, \text{ and } \frac{dq_3}{dp_2} = 0.$$

Inserting these facts in (15), it is seen that, over the interval $p_2 > a+K+S$, the derivative of the objective function with respect to p_2 is $F(p_2) > 0$. This establishes that the optimal value of p_2 cannot lie in this interval.

Next consider the interval, $p_2 < a+K+S$. For any p_2 in this interval, Lemma 3 implies that $p_3 = p_2$, and $\frac{dp_3}{dp_2} = 1$. Also, either $q_3 < b$ or $q_3 = b$, depending on which value of p_2 is picked in this interval. If $q_3 < b$, then from (A18) $\frac{dq_3}{dp_2} = 1$, and from (15) the derivative of the objective function with respect to p_2 is:

$$2F(p_2) - (K+S)[f(p_2) + f(q_3)] = [2/(b-a)][p_2 - a - K - S] < 0, \ \forall \ p_2 < a+K+S.$$

Thus, for any $p_2 < a+K+S$ which results in $q_3 < b$, the objective function is strictly decreasing in p_2 . Clearly, no such value of p_2 can be optimal. Now consider $q_3 = b$. In this case $\frac{dq_3}{dp_2} = 0$, and the derivative of the objective function with respect to p_2 is:

$$2F(p_2) - (K+S)f(p_2) = [1/(b-a)][2(p_2-a)-K-S]$$

implying that $p_2 = a + 1/2 (K+S)$ is optimal. But, from (A22), $q_3 = b$ is optimal when $p_2 = a + 1/2 (K+S)$ only if $K+S \geq 2/3 (b-a)$.

The above analysis establishes that when $K+S \geq 2/3 (b-a)$, equilibrium audit prices are: $p_3 = p_2 = a + 1/2 (K+S)$, and $q_3 = b$, establishing (iii) of Proposition 4.

The only case that remains to be considered is $1/2 (b-a) < K+S < 2/3 (b-a)$. We will establish that in this case equilibrium audit prices are $p_3 = p_2 = b-(K+S)$, and $q_3 = b$. This result is obtained by establishing that the objective function is strictly decreasing in p_2 to the left of $b-(K+S)$ and strictly increasing to the right of this point.

Consider the interval $p_2 < b-(K+S)$. In this interval $p_2 < a+K+S$ since $K+S > \{1/2\}(b-a)$. Therefore, optimally $p_3 = p_2$, and $q_3 < b$, so that $\frac{dq_3}{dp_2} = \frac{dp_3}{dp_2} = 1$. The derivative of the objective function with respect to p_2 is:

$$2F(p_2) - (K+S)[f(p_2) + f(q_3)] = \{2/(b-a)\}[p_2-a-K-S] < 0,$$

establishing that the objective function is strictly decreasing to the left of $b-(K+S)$.

Next, consider the interval $p_2 > b-(K+S)$. Given any p_2 in this interval, (A22) implies that optimally $q_3 = b$ and $\frac{dq_3}{dp_2} = 0$. There are two subintervals to consider, $p_2 \leq a+K+S$, and $p_2 > a+K+S$. Suppose p_2 lies in the first subinterval. Then optimally $p_3 = p_2$. Therefore, the objective function has slope:

$$2F(p_2) - (K+S)f(p_2) = \{2(p_2-a) - (K+S)\}/(b-a) > 0 \text{ iff } p_2 > a+(1/2)(K+S)$$

Now, in the case under consideration where $K+S \leq (2/3)(b-a)$, we have $b-(K+S) \geq a+(1/2)(K+S)$. Therefore $p_2 > b-(K+S)$ implies that the slope of the objective function is strictly positive. On the other hand, suppose $p_2 > a+K+S$. In this case, $\frac{dp_3}{dp_2} = 0$, and the slope of the objective function is

$F(p_2) > 0$. Thus, in each of the two possible subintervals the objective function is strictly increasing to the right of $b-(K+S)$. Therefore the optimal value of p_2 is $b-(K+S)$, in which case (A22) implies that $q_3 = b$.



References

- Baiman, S., J. H. Evans III, and J. Noel. 1987. Optimal contracts with a utility maximizing auditor. *Journal of Accounting Research* 25 (Autumn): 217-244.
- Baron, D. P., and D. Besanko. 1984. Regulation and information in a continuing relationship. *Information Economics and Policy* 1: 267-302.

- . 1987. Commitment and fairness in a dynamic regulatory relationship. *Review of Economic Studies* LIV: 413-436.
- DeAngelo, L. E. 1981a. Auditor independence, "low balling," and disclosure regulation. *Journal of Accounting and Economics* (August): 113-127.
- . 1981b. Auditor size and audit quality. *Journal of Accounting and Economics* (December): 183-199.
- Dye, R. A. 1991. Informationally motivated auditor replacement. *Journal of Accounting and Economics* (December): 347-374.
- Gibbons, R. 1987. Piece-rate incentive schemes. *Journal of Labor Economics* 5: 413-429.
- Gigler, F., and M. Penno. 1993. Pricing and switching behavior in an imperfectly competitive audit market. Working paper, University of Chicago, Chicago, IL.
- Laffont, J. J., and J. Tirole. 1988a. The dynamics of incentive contracts. *Econometrica* (September) :1153-1175.
- . 1988b. Repeated auctions of incentive contracts, investments and bidding parity with an application to takeovers. *Rand Journal of Economics* (Winter): 516-537.
- Magee, R., and M. Tseng. 1990. Audit pricing and independence. *The Accounting Review* 65 (April):315-336.
- Melumad, N., and L. Thoman. 1990. On auditors and the courts in an adverse selection setting. *Journal of Accounting Research* (Spring): 77-120.
- Riordan, M., and D. E. Sappington. 1989. Second sourcing. *Rand Journal of Economics* (Spring): 41-58.

Accounting for the Multinational Firm: Is the Translation Process Valued by the Stock Market?

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SYNOPSIS AND INTRODUCTION: This study examines whether the stock market considers foreign exchange transaction and translation gains and losses when pricing equity securities, and whether the value assigned by the market is significantly different from that assigned to other components of accounting earnings. It also examines whether the market's valuation of foreign exchange gains and losses differed in the periods covered by Statement of Financial Accounting Standards (SFAS) 8 and SFAS 52.

For a sample of firms affected by both SFAS 8 and SFAS 52, we find evidence that the market incorporates information on foreign exchange gains and losses reported in income when valuing equity securities. The market appears to use this information in a manner similar to the way it uses other earnings information; we find this result for the foreign exchange gains and losses calculated under both standards. We also find that the market incorporated foreign translation gain and loss information reported in stockholders' equity under SFAS 52 when valuing equity securities, but the effect of this information on stock prices was smaller than the effect of other earnings.

The results are consistent with the market using earnings-related information reported directly in stockholders' equity and not on the income statement. Overall, the results support the contention that foreign currency translation adjustments should be separated from other earnings components in the financial statements.

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Data Availability: *A list of the sample firms may be obtained from the authors. The remainder of the data is available from the sources indicated in the text.*

THE paper proceeds as follows. Section I provides a brief background and the motivation for the study. Section II describes the research design. Section III explains how the sample was derived and provides some descriptive statistics. Section IV presents the empirical results, and section V provides the conclusions.

I. Background and Motivation

Accounting policy makers have had difficulties in setting standards for companies that operate in more than one currency environment. The root of the problem is the translation process, whereby the financial statements of foreign subsidiaries are remeasured in the currency of the parent company. Prior to 1975, U.S. firms had substantial discretion when choosing a method of foreign currency translation. Since that time, however, the Financial Accounting Standards Board (FASB) has issued two standards on foreign currency translation. The first standard, SFAS 8, required firms to use the temporal method of translating foreign currency and included foreign transaction and translation gains and losses in net income. The FASB issued its second major translation accounting standard, SFAS 52, in 1981. Firms whose foreign subsidiaries operated primarily in a currency other than the U.S. dollar were required to use the current rate method of translation. Translation gains and losses were excluded from income and reported as a separate component in the stockholders' equity section of the statement of financial position. This new standard was expected to reduce the volatility of earnings and make financial statements more understandable (Seidler and McConnell 1982; Griffin and Castanias 1987). However, some accountants have argued that under certain conditions, translation gains and losses are important performance indicators and that the informativeness and quality of earnings may deteriorate when foreign translation gains and losses are excluded from reported earnings (Beaver and Wolfson 1982, 1984).¹

Most of the research on SFAS 8 and SFAS 52 has examined the capital market impact of their passage and adoption (see for example, Dukes 1978; Makin 1978; Shank et al. 1979; Kim 1985; Garlicki et al. 1987; Ziebart and Kim 1987; Salatka 1989; Kim and Ziebart 1991). Other studies have examined how firms altered their operating behavior to compensate for the effect of these standards on reported income (Evans et al. 1978; Choi et al. 1978; Rodriguez 1980 and Arnold and Holder 1986 are a few examples). These studies hypothesize that the inclusion of foreign translation gains and losses in income would lead firms to engage in costly foreign currency management practices. Implicit in most of these studies is the assumption that either the stock market values foreign translation gains and losses or managers believe that the market operates in this manner.

¹Beaver and Wolfson (1982) show that when exchange rates are driven solely by differences in inflation rates among countries and under perfect and complete markets (a sufficient but not necessary condition), only a current cost accounting system with translation at current rates of exchange would satisfy the notions of economic interpretability and symmetry. They further prove that the inclusion of the translation gains and losses in income is necessary in order for any method to achieve either economic interpretability or symmetry. Beaver and Wolfson (1984) argue that excluding translation gains and losses from earnings can provide misleading earnings-based performance evaluations.

Foreign *transaction* gains and losses arise when companies have outstanding contracts fixed in terms of a foreign currency, and the exchange rate between that currency and that of the company changes during an accounting period. Such gains and losses have a relatively direct impact on cash flow and, under both SFAS 8 and SFAS 52, are included in net income. Foreign *translation* gains and losses arise because of the need to consolidate foreign subsidiaries' accounts in terms of their parent's currency. Changes in the exchange rate between the parent's currency and a subsidiary's currency will lead to translation gains and losses even if the subsidiary's financial position does not change.

Most firms have argued that translation gains and losses are unrealized and have no direct cash flow effect (FASB 1981, ¶156). If the market also has this belief, then the impact of translation gains and losses in net income under SFAS 8 and in stockholders' equity under SFAS 52 would be discounted or even ignored. This may explain why no consistent evidence has been found regarding the effect of SFAS 8 and SFAS 52 on market values (see Houston 1989 for a summary of the extant literature). Alternatively, it may be argued that changes in foreign exchange rates also reflect changes in countries' interest and inflation rates (Solnik 1978; Adler and Dumas 1983). Translation gains and losses may, therefore, provide information, albeit imperfect, about a firm's foreign exposure. Beaver and Wolfson (1982, 1984) argue that translation gains and losses should be included in income in order to reflect the economic factors behind the interplay of interest rates and exchange rates. The potential absence of a direct cash flow impact and the potential for future reversal, however, suggest that the "persistence" (Lipe 1986) of translation gains and losses could be different from that of other earnings.

Recent work by Collins and Salatka (1993) compared the quarterly earnings response coefficients of a sample of 27 multinational firms with a control sample of non-multinational firms. They hypothesized that "earnings quality," as measured by the size of the earnings response coefficient, would be poorer for the multinational firms under SFAS 8, but would improve under SFAS 52. They found results consistent with the above hypotheses. Gilbert (1989), however, found no significant difference in annual earnings response coefficients over the two periods for a sample of 343 multinational firms. Both of these studies utilized net earnings, including foreign currency gains and losses,² in their measurement of earnings response coefficients. For most of the firms examined in these studies, however, non-foreign currency earnings constitute a larger component of net income; therefore, fluctuations in non-foreign currency earnings may overshadow any valuation effects of foreign currency gains and losses.

By examining the response coefficients assigned to foreign currency gains and losses **separately** from those assigned to other earnings, we provide a more direct test of whether the market valued foreign exchange gain and loss information and whether that valuation changed after SFAS 52. We also explicitly model the market's assessment of the foreign translation gains and losses reported in stockholders' equity and provide additional evidence of whether the market values this component.

II. Research Design

Under SFAS 8, aggregate foreign exchange gains and losses were reported in the income statement. Under SFAS 52, translation gains and losses for foreign subsidiaries whose functional currency (the primary operating currency) is the local currency are reported in a cumulative

² We use the terms "foreign currency" or "foreign exchange" gains and losses to refer to any combination of the foreign transaction and translation gains and losses.

translation adjustment to stockholders' equity. Firms with subsidiaries in hyperinflationary economies or whose functional currency is the U.S. dollar, however, are required to remeasure their books into the functional currency, and gains and losses arising from this remeasurement are recognized in income. We exclude all firms with only U.S. dollar functional currency subsidiaries from our sample.³

Foreign transaction gains and losses were not consistently reported separately from foreign translation gains and losses prior to SFAS 52; therefore, we devise our tests based on two firm-specific periods: the period after a firm had adopted SFAS 8 but before it adopted SFAS 52 (Post-8) and the period after SFAS 52 adoption (Post-52). This design allows us to test two issues. First, we can examine whether the market's valuation of foreign exchange gains and losses in income differed under the two standards. Second, we can examine whether the market weighs foreign translation gains and losses differently from foreign transaction gains and losses and from other earnings.

We utilize two models of analysts' predictions of foreign exchange gains and losses. Because analysts do not separately disclose such forecasts, we assume that analysts use either a white noise (zero mean) or a random walk expectations model of foreign exchange gains and losses.⁴ We estimate the following two models to test the market's valuation of the foreign exchange gains and losses:

$$CAR_i = \alpha_0 + \alpha_1 UE_{it} + \alpha_2 FORIS_i + \alpha_3 FORSE_i + \varepsilon_i \quad (1)$$

$$CAR_i = \beta_0 + \beta_1 UE_{it} + \beta_2 \Delta FORIS_i + \beta_3 \Delta FORSE_i + e_i \quad (2)$$

where:

- CAR = three-day cumulative abnormal stock returns around the annual earnings announcement date.
- UE = analysts' forecast errors, as a proxy for unexpected earnings, adjusted for the impact of the foreign exchange gain or loss included in income (see definition below).
- FORIS = foreign exchange gain or loss reported in the income statement, as a proxy for the unexpected foreign exchange gain or loss included in income.
- $\Delta FORIS$ = change in foreign exchange gain or loss from the prior year, i.e., $FORIS_t - FORIS_{t-1}$, as a proxy for the unexpected foreign exchange gain or loss included in income.
- FORSE = change in cumulative foreign translation adjustment reported in stockholders' equity, as a proxy for the unexpected foreign translation gain or loss in stockholders' equity.
- $\Delta FORSE$ = change in FORSE, i.e., $FORSE_t - FORSE_{t-1}$, as a proxy for the unexpected foreign translation gain or loss in stockholders' equity.

³Thirteen firms were excluded because of this requirement. For ease of exposition, we will subsequently state that translation gains and losses are reported directly in stockholders' equity subsequent to SFAS 52, recognizing that in some instances, a portion of the foreign currency gain or loss in income will include translation gains and losses for U.S. dollar functional currency subsidiaries and subsidiaries in hyperinflationary economies.

⁴Our use of the random walk and white noise expectations models is based on the extensive literature that has modeled earnings or earnings components expectations using either of the two models (see for example, Warfield and Linsmeier (1992) who use a white noise model for securities gains and losses and Bowen et al. (1987) who use a random walk model for cash flow). The mean (median) absolute foreign exchange gain or loss in income per share and change in foreign exchange gain or loss in income per share, as proxies for average absolute forecast error, were 0.0129 (0.0024) and 0.0176 (0.0024), respectively. Both variables were reliably different from zero, but not statistically different from each other (t-statistic = 1.1996). Because neither model appeared to be better than the other in "forecasting" foreign exchange gains and losses, we report the results using both models.

All independent variables are computed on a per share basis, scaled by stock price at the beginning of the year.

Easton and Harris (1991) document that the level of earnings is significant in explaining raw stock returns, over and above the information contained in the change in earnings variable. To examine if our results are affected by measurement error, we also conduct our tests using a variant of the Easton and Harris (1991) model. Specifically, we use raw returns over the three-day earnings announcement window as our dependent variable and simultaneously include the level of earnings (ADJEP) and analysts' forecast errors as proxies for unexpected earnings. We also include both FORIS and Δ FORIS, the level of and change in foreign exchange gains and losses in income, respectively, in the same models:

$$RRET_i = \eta_0 + \eta_1 UE_{1i} + \eta_2 ADJEP_i + \eta_3 FORIS_i + \eta_4 \Delta FORIS_i + \eta_5 FORSE_i + \mu_i \quad (3)$$

$$RRET_i = \lambda_0 + \lambda_1 UE_{2i} + \lambda_2 ADJEP_i + \lambda_3 FORIS_i + \lambda_4 \Delta FORIS_i + \lambda_5 \Delta FORSE_i + v_i \quad (4)$$

where:

RRET = raw stock market returns calculated over the three-day period surrounding the earnings announcement date.

ADJEP = earnings per share minus the foreign exchange gain or loss in income, scaled by the beginning-of-the-year stock price.

Because our sample consists only of large firms that have analysts' forecasts, it is likely that the foreign currency gains and losses in income and equity are known at the time of earnings announcements.⁵ We therefore estimate the models using returns computed over the three-day window surrounding the earnings announcement as disclosed in the *Wall Street Journal Index*. Cumulative abnormal returns are computed based on the single factor market model (Fama 1976). A 200-day estimation period is used to estimate parameter coefficients, beginning from day -210 to day -11.

Unexpected earnings are proxied by the difference between reported earnings and analysts' forecasts. Because we do not know whether or how analysts incorporate the foreign exchange gains and losses in their earnings forecasts, we utilize two measures of unexpected earnings:

$$UE_1 = (EPS_t - AF_t)/PRICE_{t-1} - FORIS_t \quad (5)$$

$$UE_2 = (EPS_t - AF_t)/PRICE_{t-1} - \Delta FORIS_t \quad (6)$$

where:

EPS = reported earnings per share.

AF = the most recent mean analysts' earnings forecast prior to earnings announcement.

PRICE = stock price at the beginning of the year.

⁵While the *Wall Street Journal* will occasionally report the amount of foreign exchange gain or loss together with a firm's earnings announcement, it generally does not publish the foreign exchange components. In conversations with stock analysts and managers, however, we were told that large firms frequently conduct live or telephone news conferences at the time of earnings announcement, at which time earnings components are often provided (see Appendix A of Francis et al. 1992). Using the Dow Jones News Retrieval Service on LEXIS, we found approximately 10% of our sample to have specifically disclosed foreign exchange gain or loss components with their annual earnings announcements. To account for the possibility that the foreign currency gains and losses are disclosed only upon issuance of firms' financial statements, we also estimated the models using returns over the three-day window surrounding the earlier of the SEC-stamped annual report or 10-K receipt date. Results are discussed in footnote 10.

UE_1 assumes that analysts ignore foreign exchange gains and losses in their earnings forecasts or treat them as a white noise process. UE_2 assumes that analysts estimate foreign exchange gains and losses in a random walk fashion, so that last year's foreign exchange gain or loss is this year's best estimate. The resulting UE measures provide estimates of analysts' error in predicting the components of earnings not associated with foreign exchange transaction and translation fluctuations.

FORIS and FORSE proxy for the unexpected foreign exchange gains and losses reported in income and stockholders' equity, respectively. To be consistent with the assumed earnings prediction models described in equations (5) and (6), we utilize two variations of FORIS and FORSE. Over the SFAS 8 period, FORIS (Δ FORIS) represents the (change in) combined foreign transaction and translation gains and losses reported in the income statement. In the SFAS 52 period, FORIS (Δ FORIS) equals only the (change in) foreign exchange gains and losses reported in income, while FORSE (Δ FORSE) corresponds to the (change in) foreign translation gains and losses reported in stockholders' equity. FORSE and Δ FORSE assume zero values in the pre-SFAS 52 period, because foreign translation gains and losses were not reported separately in stockholders' equity at the time.

Based on prior earnings information research, the UE coefficients should be significantly positive. If the foreign exchange gains and losses are given the same weight as the other components of earnings, then the coefficients for FORIS (Δ FORIS) and FORSE (Δ FORSE) should approximately equal those of UE_1 (UE_2). Furthermore, if the market values foreign transaction gains and losses differently from foreign translation gains and losses, then the coefficients for FORIS (Δ FORIS) should be significantly different from those of FORSE (Δ FORSE). The models are separately estimated under SFAS 8 and SFAS 52 to determine if the market's valuation of the foreign exchange gains and losses differed under the two standards.⁶

III. Sample and Descriptive Characteristics

A sample of firms which adopted SFAS 52 was initially obtained from Gilbert (1989). These firms were identified by examining MOODY's 1984 *Industrial Manual* and *Industrial OTC Manual* for the presence of a cumulative translation adjustment account in the equity section of the balance sheet. This screen produced a total of 1,008 firms which were affected by SFAS 52. In addition, the following data requirements were imposed:

1. Foreign exchange gains and losses and the cumulative translation adjustment could be identified in COMPUSTAT or in the annual reports or Form 10-Ks from NAARS and Disclosure Inc.
2. Earnings forecast was available on the I/B/E/S historical summary tape.
3. Stock returns were available on CRSP.
4. Earnings announcement date was available in Quarterly COMPUSTAT or the *Wall Street Journal Index*.
5. Annual report or Form 10-K submission date to the SEC was available.
6. Foreign operations accounted for at least 10% of sales or identifiable assets.⁷
7. At least one foreign subsidiary must have used the local foreign currency as its functional currency.

⁶To the extent our sample includes firms with one or more U.S. dollar functional currency subsidiaries, our ability to detect a significant change in the FORIS (Δ FORIS) weight from SFAS 8 to SFAS 52, as well as to find a significant difference in weights between FORIS (Δ FORIS) and FORSE (Δ FORSE), may be reduced.

⁷Annual reports in the year of SFAS 52 adoption were examined to ascertain the extent of firms' foreign operations. According to SFAS 14 (FASB 1976), firms whose foreign operations account for at least ten percent of sales or identifiable

These data constraints reduced the sample to 235 firms. We chose to examine the seven years covered by SFAS 8 for which I/B/E/S data were available (1976-82) and a corresponding seven years under SFAS 52 (1981-87). The data availability screens resulted in a sample of 1,541 firm-year observations. The final screen applied to the sample was in response to recent research which has found evidence that the price-earnings relationship may not be linear (Freeman and Tse 1992; Cheng et al. 1992). In particular, it is theorized that large abnormal unexpected earnings are assigned a lower weight due to the presence of transitory gains and losses. In order to mitigate the impact of these large transitory gains and losses in the coefficient comparisons, we excluded all firm-years with scaled absolute explanatory variables in excess of 0.10. This resulted in a final sample consisting of 1,474 firm-years (1,471 for the random walk model), representing over 95 percent of the original sample. Of these firm-year observations, 753 were from the SFAS 8 period (1976-82) and 721 were from the SFAS 52 period (1981-87). Table 1 provides a summary of the sample selection process and the distribution of observations by years and year of adoption.

We were unable to determine the exact year of adoption of SFAS 8 for 11 firms, representing 21 firm-year observations (1.4% of the sample). We included them as long as their footnote indicated a translation method identical to that prescribed by SFAS 8. Table 1 indicates that there is no significant clustering of observations by year. Nineteen seventy-nine and 1980 had the most observations (164), representing 11.1% of the total sample in each year.⁸

Table 2 provides some descriptive statistics for the final sample. We find in panel A of table 2 that the mean (median) foreign currency gain and loss included in income was -\$0.588 (-\$0.218) million over the entire period. The mean (median) change in cumulative foreign translation gain and loss in stockholders' equity was smaller at -\$4.559 (-\$0.570) million. In panel B, we separate the gains from losses and scale them by the absolute value of net income. Foreign currency losses averaged (median) 9.90% (3.43%) of absolute income, while foreign currency gains averaged (median) 8.79% (2.44%) of absolute income. In the Post-52 period, foreign translation losses in equity averaged (median) over 26 percent (13 percent) of absolute income, while foreign translation gains averaged (median) 42 percent (12 percent) of absolute income. In panel C, we provide the foreign currency and translation gain and loss variables classified by SFAS period. The percentage of foreign currency gain and loss in income did not statistically change in magnitude from SFAS 8 to SFAS 52 (t-statistic of -1.3744, p-value of 0.1696), nor was the scaled foreign currency translation gain and loss included in equity statistically greater than the scaled foreign currency gain and loss in income (t-statistic of 0.9069, p-value of 0.3648).

Table 3 provides some descriptive statistics and correlations of the variables used in the regressions. Over a narrow return window, we find CAR to be significantly correlated with RRET ($\rho = 0.9295$). UE_1 and UE_2 are highly positively correlated ($\rho = 0.6371$), as are FORIS and Δ FORIS ($\rho = 0.3091$), and FORSE and Δ FORSE ($\rho = 0.6302$). These correlations will reduce the ability of the tests to differentiate the predictive power of the white noise from the random walk specification. FORIS is significantly positively correlated with FORSE ($\rho = 0.1987$), but Δ FORIS and Δ FORSE are only weakly correlated ($\rho = 0.0691$). The level of earnings variable, ADJEP,

assets are required to disclose information about their foreign segments. We assume that if this disclosure was not made, foreign operations were not material enough to warrant inclusion in the sample. Therefore, if the firm explicitly stated that foreign operations were insignificant or simply disclosed no foreign segment data, the firm was deleted from the sample.

⁸We also classified the firms in the sample by their two-digit SIC industry codes. Thirty-six industry groups are represented. Firms with two-digit SIC codes 28 (chemicals and drugs) and 35 (machinery and computers) had the greatest representation, 20.4% and 19.6%, respectively. All other groups had less than ten percent of the total observations. Tests were conducted excluding both of these industry groups. Results were qualitatively similar to those obtained for the sample as a whole.

Table 1
Sample Selection Process

Panel A: Sample Selection Criteria

Firms in MOODY's Industrial and OTC Manuals reporting a cumulative translation adjustment		1,008
Less: Firms not on COMPUSTAT, IBES and CRSP	- 645	
Firms with no earnings announcement, annual report and 10-K stamp date	23	
Firms with insignificant foreign operations	<u>105</u>	<u>773</u>
Final Sample		<u><u>235</u></u>

Panel B: SFAS Adoption Distribution

SFAS No. 8		
1975	134	57.0%
1976	74	31.5
1977	16	6.8
Indeterminate	<u>11</u>	<u>4.7</u>
Total	<u><u>235</u></u>	<u><u>100.0%</u></u>
SFAS No. 52		
1981	92	39.2%
1982	107	45.5
1983	<u>36</u>	<u>15.3</u>
Total	<u><u>235</u></u>	<u><u>100.0%</u></u>

Panel C: Year Distribution

1976	101	6.9%
1977	52	3.5
1978	142	9.6
1979	164	11.1
1980	164	11.1
1981	113	7.7
1982	119	8.1
1983	113	7.7
1984	154	10.4
1985	158	10.7
1986	155	10.5
1987	<u>39</u>	<u>2.6</u>
Total	<u><u>1,474</u></u>	<u><u>100.0%</u></u>

Table 2
Descriptive Statistics^a

Panel A: Values in Millions of US \$

	<i>Total Assets</i>	<i>Net Income</i>	<i>Foreign Currency Gain/Loss in Income</i>	<i>Foreign Currency Gain/Loss in Equity</i>
MEAN	3259.80	227.13	-0.588	-4.559
MEDIAN	1168.18	76.02	-0.218	-0.570
MINIMUM	30.84	-398.10	-316.000	-1307.000
1ST QUARTILE	426.27	23.78	-3.168	-14.400
3RD QUARTILE	2837.63	193.40	0.339	5.742
MAXIMUM	69484.00	6582.00	710.000	1773.000
STD. DEV.	7090.82	603.88	28.85	137.86

Panel B: Values Scaled by Absolute Net Income^b

	<i>Foreign Currency in Income</i>		<i>Foreign Currency in Equity</i>	
	<i>Losses</i>	<i>Gains</i>	<i>Losses</i>	<i>Gains</i>
MEAN	-0.0990	0.0879	-0.2684	0.4274
MEDIAN	-0.0343	0.0244	-0.1324	0.1215
MINIMUM	-7.2109	0.0000	-11.5000	0.0014
1ST QUARTILE	-0.0799	0.0090	-0.2704	0.0531
3RD QUARTILE	-0.0159	0.0600	-0.0492	0.2763
MAXIMUM	-0.0003	3.5516	-0.0001	17.7632
STD. DEV.	0.3846	0.3117	0.9006	1.3730
NUMBER OF OBS	798	446	405	306
T-stat (=0)	-7.2583	5.9526	-5.9968	5.4452

Panel C: Values Scaled by Absolute Net Income Classified by Period

	<i>Foreign Currency Gain/Loss in Income</i>		<i>Foreign Currency Translation Gain/Loss in Equity</i>
	<i>Post-8, Pre-52</i>	<i>Post-52</i>	<i>Post-52</i>
MEAN	-0.0391	-0.0147	0.0308
MEDIAN	-0.0130	0.0000	-0.0176
MINIMUM	-7.2109	-1.5223	-11.5000
1ST QUARTILE	-0.0435	-0.0332	-0.1563
3RD QUARTILE	0.0082	0.0022	0.0925
MAXIMUM	3.2727	3.5516	17.7632
STD. DEV.	0.4008	0.2675	1.1733
T-stat (=0)	-2.6668	-1.4721	0.7029

^aDescriptive statistics are computed on the final sample of 1,474 firm-years representing 235 firms.

^bThere were 230 firm-years (primarily in the SFAS 52 period), for which foreign currency gains and losses in income were either zero or immaterial. There were also ten firm-years which reported zero or immaterial change in foreign translation gains and losses in stockholders' equity.

Table 3
Descriptive Statistics on Model Variables^a

Panel A: Descriptive Statistics									
	CAR	RRET	UE ₁	UE ₂	ADJEP	FORIS	ΔFORIS	FORSE ^b	ΔFORSE ^b
Mean	-0.0013	-0.0049	0.0008	-0.0010	0.0961	-0.0022	-0.0005	-0.0044	0.0034
Std. Dev.	0.0382	0.0406	0.0203	0.0315	0.0602	0.0100	0.0254	0.0214	0.0227
1st Q	-0.0203	-0.0270	-0.0030	-0.0051	0.0658	-0.0040	-0.0022	-0.0126	-0.0041
Median	-0.0002	-0.0043	0.0012	0.0002	0.0934	-0.0005	0.0000	-0.0012	0.0012
3rd Q	0.0187	0.0182	0.0068	0.0050	0.1287	0.0005	0.0022	0.0059	0.0113
Panel B: Pearson Correlations Coefficients (p-values)									
	CAR	RRET	UE ₁	UE ₂	ADJEP	FORIS	ΔFORIS	FORSE ^b	ΔFORSE ^b
RRET	0.9295 (0.0001)	1.0000							
UE ₁	0.1307 (0.0001)	0.1494 (0.0001)	1.0000						
UE ₂	0.0766 (0.0033)	0.0905 (0.0005)	0.6371 (0.0001)	1.0000					
ADJEP	0.0108 (0.6791)	0.0286 (0.2730)	0.4731 (0.0001)	0.2730 (0.0001)	1.0000				
FORIS	-0.0113 (0.6642)	-0.0120 (0.6463)	-0.4430 (0.0001)	-0.2171 (0.0001)	-0.2495 (0.0001)	1.0000			
ΔFORIS	0.0053 (0.8398)	0.0027 (0.9179)	-0.1638 (0.0001)	-0.8146 (0.0001)	-0.0581 (0.0258)	0.3091 (0.0001)	1.0000		
FORSE ^b	0.0704 (0.0589)	0.0596 (0.1097)	-0.1642 (0.0001)	-0.1282 (0.0006)	-0.1204 (0.0001)	0.1987 (0.0001)	0.1225 (0.0010)	1.0000	
ΔFORSE ^b	0.0521 (0.1624)	0.0483 (0.1953)	-0.0956 (0.0103)	-0.0848 (0.0228)	-0.1523 (0.0001)	0.0870 (0.0194)	0.0691 (0.0636)	0.6302 (0.0001)	1.000

(Continued)

Table 3 (Continued)

^a Descriptive statistics are computed on the final sample of 1,474 firm-years representing 235 firms. Variable definitions:

CAR = three-day cumulative abnormal stock returns around the annual earnings announcement date.

RRET = three-day raw stock market returns around the annual earnings announcement date.

UE₁ = unexpected earnings, proxied by analyst forecast errors, adjusted for the impact of foreign exchange gain or loss under a white noise (zero mean) specification.

UE₂ = unexpected earnings, proxied by analyst forecast errors, adjusted for the foreign exchange gain or loss under a random walk specification.

ADJEP = level of earnings, adjusted for foreign exchange gain or loss in income.

FORIS = foreign exchange gain or loss reported in the income statement, as a proxy for unexpected exchange gain or loss in income.

ΔFORIS = change in foreign exchange gain or loss from the prior year, as a proxy for unexpected foreign exchange gain or loss in income.

FORSE = change in cumulative foreign translation adjustment reported in stockholders' equity, as a proxy for unexpected annual foreign translation gain or loss in stockholders' equity.

ΔFORSE = change in FORSE, as a proxy for unexpected annual foreign translation gain or loss in stockholders' equity.

All earnings variables are scaled by beginning of period stock price.

^b Statistics cover post-52 period only.

Table 4
Regression Results^a Coefficients and (T-statistics)

Panel A: (WN) $CAR_i = \alpha_0 + \alpha_1 UE_{it} + \alpha_2 FORIS_i + \alpha_3 \Delta FORIS_i + \alpha_4 \Delta FORSE_i + \alpha_5 \Delta FORSE_i + \epsilon_i$ (RW) $CAR_i = \beta_0 + \beta_1 UE_{it} + \beta_2 \Delta FORIS_i + \beta_3 \Delta FORSE_i + \epsilon_i$									
MODEL ^b	INTERC	UE	FORIS	$\Delta FORIS$	FORSE	$\Delta FORSE$	R ²	F-stat	
WN: POST8	-0.0019 (-1.380)	0.4403** (5.170)	0.3610** (2.565)	-	-	-	0.0320	13.439**	
WN: POST52	-0.0000 (-0.021)	0.2301** (2.915)	0.0657 (0.456)	-	0.1621* (1.899)	-	0.0152	4.694**	
RW: POST8	-0.0015 (-1.091)	0.4807** (4.727)	-	0.4073** (2.375)	-	-	0.0378	15.753**	
RW: POST52	-0.0009 (-0.604)	0.2442** (3.310)	-	0.3527* (1.817)	-	0.0707 (1.061)	0.0127	4.074**	
Panel B: (EHWN) $RRET_i = \eta_0 + \eta_1 UE_{it} + \eta_2 \Delta JEP_i + \eta_3 FORIS_i + \eta_4 \Delta FORIS_i + \eta_5 \Delta FORSE_i + \eta_6 \Delta FORSE_i + \mu_i$ (EHRW) $RRET_i = \lambda_0 + \lambda_1 UE_{it} + \lambda_2 \Delta JEP_i + \lambda_3 FORIS_i + \lambda_4 \Delta FORIS_i + \lambda_5 \Delta FORSE_i + \lambda_6 \Delta FORSE_i + \nu_i$									
MODEL	INTERC	UE	ADJEP	FORIS	$\Delta FORIS$	FORSE	$\Delta FORSE$	R ²	F-stat
EHWN: POST8	-0.0036 (-0.999)	0.4848** (5.290)	-0.0114 (-0.400)	0.3557* (2.307)	0.0199 (0.467)	-	-	0.0324	7.286**
EHWN: POST52	-0.0005 (-0.169)	0.3735** (4.143)	-0.0502 (-1.498)	0.1399 (0.660)	0.0538 (0.248)	0.1297* (1.670)	-	0.0210	4.084**
EHRW: POST8	-0.0035 (-0.967)	0.5252** (5.672)	-0.0116 (-0.400)	-0.1674 (-1.149)	0.4864** (3.187)	-	-	0.0395	8.715**
EHRW: POST52	-0.0000 (0.027)	0.4026** (4.404)	-0.0639 (-1.623)	-0.0488 (-0.244)	0.5493** (2.323)	-	0.0575 (0.792)	0.0225	4.313**

(Continued)

Table 4 (Continued)

^aRegression models are estimated over two periods: The POST8 period is estimated over the post-SFAS 8, pre-SFAS 52 period, while the POST52 model is estimated over the post-SFAS 52 period. N=753 for the Post-8 period and N=721 for the Post-52 period under the white noise specification; N=752 for the Post-8 period and N=719 for the Post-52 period under the random walk specification.

^bModel WN assumes a white noise expectations model for foreign currency gains or losses, while Model RW assumes a random walk expectations model. Variable definitions (all scaled by beginning of the period stock price):

CAR = three-day cumulative abnormal stock returns around the annual earnings announcement date.

RRET = three-day raw stock market returns around the annual earnings announcement date.

UE₁ = unexpected earnings, proxied by analyst forecast errors, adjusted for the impact of foreign exchange gain or loss under a white noise (zero mean) specification.

UE₂ = unexpected earnings, proxied by analyst forecast errors, adjusted for the impact of foreign exchange gain or loss under a random walk specification.

ADJEP = level of earnings per share, adjusted for foreign exchange gain or loss.

FORIS = foreign exchange gain or loss reported in the income statement, as a proxy for the unexpected foreign exchange gain or loss in income.

ΔFORIS = change in foreign exchange gain or loss from the prior year, as a proxy for the unexpected foreign exchange gain or loss in income.

FORSE = change in cumulative foreign translation adjustment reported in stockholders' equity, as a proxy for the unexpected annual foreign translation gain or loss in stockholders' equity.

ΔFORSE = change in FORSE, as a proxy for the unexpected annual foreign translation gain or loss in stockholders' equity.

* Significant at the 5% level, one-tailed test

** Significant at the 1% level, one-tailed test

is highly correlated with the two unexpected earnings proxies ($\rho = 0.4731$ and 0.2730), but is not significantly correlated with either CAR or RRET. All of the foreign exchange variables are significantly negatively correlated with all of the unexpected earnings proxy variables. CAR and RRET are significantly correlated with UE_1 and UE_2 and with FORSE (at the 6 percent and 11 percent levels, respectively), but are not significantly correlated with FORIS, Δ FORIS, or Δ FORSE on a univariate basis. The implications of this lack of correlation and tests for the effects of multicollinearity on the regressions are discussed in the subsequent section.

IV. Empirical Results

We report the regression results from estimating the white noise (WN:equation 1) and random walk (RW:equation 2) models in panel A of table 4. Panel B shows the results of using the Easton and Harris (1991) models (EHWN:equation 3, EHRW:equation 4). The statistics are computed using White-adjusted (White 1980) errors for models that showed evidence of heteroskedasticity.

In panel A, we find all models to be significant, with adjusted r-squares ranging from 1.52% to 3.78%. As expected, UE has a significantly positive coefficient (at less than the one percent level), with coefficients ranging from 0.2301 to 0.4807.⁹ Moreover, both FORIS and Δ FORIS have significantly positive coefficients (at less than the one percent level) in the post-8 period, but only Δ FORIS has a significantly positive coefficient (at less than the five percent level) in the post-52 period. In the post-52 period, FORSE is also significantly positive at the five percent level. These results are generally consistent with the market using the foreign currency gain and loss information reported in income, as well as the foreign translation gain and loss included in stockholders' equity.¹⁰

In panel B, we present the results of the Easton and Harris-based models. All of the original variables retain statistical significances similar to those reported in panel A. The level of earnings, ADJEP, is negative and not significant in either model. For comparison, we also conducted the same regressions using cumulative abnormal returns (CAR) as the dependent variable. The inferences are similar to those using raw returns. Taken together, these results suggest, at least over this narrow return window, that the level of earnings was not a correlated, omitted variable.¹¹

Regression models were examined for evidence of multicollinearity and autocorrelation. Using Belsley et al. (1980) condition indices, no evidence of significant multicollinearity was detected. Belsley et al. (1980, 153) report that *weak* dependencies occur at condition indices of

⁹For comparison, Collins and Salatka (1993) report adjusted r-squares of 8.6-8.9% over the period 1976-87, excluding 1980-81. Their earnings response coefficient (including foreign exchange gains and losses) averaged 0.595 in the SFAS 8 period and 0.547 in the SFAS 52 period. The differences may be due to Collins and Salatka's use of quarterly earnings and a smaller sample of firms ($n=27$). In another related study, Garlicki et al. (1987) regressed abnormal returns on unexpected annual earnings, excluding the impact of adopting SFAS 52, for a sample of 151 firms in 1982 and found adjusted r-squares in the range of 3.18-5.02%, and earnings response coefficients (scaled by actual earnings) of 0.025-0.068.

¹⁰We also conducted the same regressions using the three-day window surrounding the earlier of the SEC-stamped annual report or 10-K receipt date. We find only Δ FORIS to be significantly positive in the Post-52 period under a random walk specification. All other variables and models are not significant. Using a cumulative abnormal return window from two days after the earnings announcement date up to two days before the financial statement release date also yielded no statistical significance for any of the variables. Consistent with Foster et al. (1986), Cready and Mynatt (1991) and Easton and Zmijewski (1993), who find no stock price response around annual report release dates, these results indicate that foreign currency earnings information is known and fully impounded at the earnings announcement date.

¹¹In a multiple regression of security returns on both the level and change of earnings variables, Easton and Harris (1991) find significantly positive coefficients for both variables. Their results are based on returns accumulated over a 12-month period, and may explain why we find no significance for the level of earnings variable.

around ten; no condition index exceeded six in any regression. Durbin-Watson statistics were used to test for evidence of significant first-order autocorrelation. None was found. The regressions were also conducted after eliminating outliers based on Belsley et al. (1980) methodology. Eliminating these observations provided results similar to those in table 4.¹²

We also ran the same regressions using CARs over 100 non-overlapping, non-event three-day windows following earnings announcement (Givoly and Hayn (1992) perform similar randomization procedures). The average adjusted r-square for all regressions was less than 0.002. The mean and median t-statistics for all of the variables were close to zero, and we could not reject the null hypothesis that any of the variables' t-values had a zero mean (using a standard t-test).

The high degree of correlation between UE_1 (UE_2) and FORIS (Δ FORIS) and the absence of a significant univariate correlation between CAR and FORIS (Δ FORIS) could indicate that the computation of UE_1 (UE_2) may be spuriously inducing the significance of FORIS (Δ FORIS) in our regressions. To examine this issue, we counted the number of times UE_1 (UE_2) and FORIS (Δ FORIS) were significant at the 10 percent level (absolute t-statistics of 1.645 or greater) for the 100 randomized regressions used above. Over the combined post-8 and 52 periods, we find UE_1 (UE_2) to be significant 11 (11) times and FORIS (Δ FORIS) to be significant 14 (14) times. However, UE_1 (UE_2) and FORIS (Δ FORIS) are simultaneously significant only 2 (1) times. This means that of the 25 instances when UE_1 (UE_2) or FORIS (Δ FORIS) were significant, they were both significant only eight percent (four percent) of the time. While we cannot entirely eliminate the possibility that measurement error in UE could be influencing the significance of FORIS and Δ FORIS, this test result would seem to indicate that the significances of FORIS and Δ FORIS are not spuriously driven by our computation of UE.

Coefficient Comparison Tests

In this section, we examine whether the weights assigned to foreign exchange gains and losses changed during the periods when firms reported according to SFAS 8 and SFAS 52. We also examine if the weights given to the income and equity adjustments differ from each other and from the weight assigned to the other components of unexpected earnings.

In panels A and B of table 5, we examine whether the weights (response coefficients) assigned to foreign exchange gains and losses and other earnings changed after SFAS 52. We do this by adding dummy interaction variables to each of the specification models and estimating the following equations:

$$CAR_i = \gamma_0 + \gamma_1 UE_{1i} + \gamma_2 D_{52} * UE_{1i} + \gamma_3 FORIS_i + \gamma_4 D_{52} * FORIS_i + \gamma_5 FORSE_i + \varepsilon_i \quad (7)$$

$$CAR_i = \delta_0 + \delta_1 UE_{2i} + \delta_2 D_{52} * UE_{2i} + \delta_3 \Delta FORIS_i + \delta_4 D_{52} * \Delta FORIS_i + \delta_5 \Delta FORSE_i + v_i \quad (8)$$

$$RRET_i = \kappa_0 + \kappa_1 UE_{1i} + \kappa_2 D_{52} * UE_{1i} + \kappa_3 ADJEP_i + \kappa_4 D_{52} * ADJEP_i + \kappa_5 FORIS_i + \kappa_6 D_{52} * FORIS_i + \kappa_7 \Delta FORIS_i + \kappa_8 D_{52} * \Delta FORIS_i + \kappa_9 FORSE_i + \xi_i \quad (9)$$

¹² The regressions were also conducted using the original (untruncated) 1,541 firm-year observations. Results for the combined period were as follows: (t-statistics in parenthesis)

(WN): $CAR = -0.001 + 0.028 UE_1 - 0.083 FORIS + 0.145 FORSE$
 (-1.312) (4.140) (-1.262) (2.879)

(RW): $CAR = -0.002 + 0.028 UE_2 + 0.026 \Delta FORIS + 0.100 \Delta FORSE$
 (-1.539) (4.145) (0.722) (2.009)

The results show significantly positive, but smaller coefficients for UE, FORSE and Δ FORSE at earnings announcement. FORIS and Δ FORIS, however, are not significant. These results were sensitive to the influence of outliers and approached the reported results in tables 4 and 5 when extreme values (representing about 3% of the sample) were deleted.

Table 5
Earnings Response Comparisons Using Earnings Announcement Date Returns

Panel A: POST-8 vs POST-52 COEFFICIENT COMPARISONS ^a (Coefficients and T-statistics)												
MODEL	INTERC	UE	D ₅₂ *UE	FORIS	D ₅₂ *FORIS	ΔFORIS	D ₅₂ *ΔFORIS	FORSE	ΔFORSE	Adj R		
WN:	-0.0010 (-0.944)	0.4357** (4.579)	-0.2147* (-1.729)	0.3741** (2.547)	-0.3322 (-1.636)	-	-	0.1540* (1.842)	-	0.0228		
RW:	-0.0012 (-1.193)	0.4795** (5.384)	-0.2380* (-2.086)	-	-	0.4057** (2.965)	-0.0552 (-0.238)	-	0.0724 (1.128)	0.0249		
Panel B: POST-8 vs POST-52 COEFFICIENT COMPARISONS (EASTON and HARRIS MODELS) ^b (Coefficients and T-statistics)												
MODEL	INTERC	UE	D ₅₂ *UE	ADJEP	D ₅₂ *ADJEP	FORIS	D ₅₂ *FORIS	ΔFORIS	D ₅₂ *ΔFORIS	FORSE	ΔFORSE	Adj R
EHWN:	-0.0016 (-0.709)	0.4947** (5.190)	-0.1381 (-1.127)	-0.026 (-1.281)	-0.014 (-0.626)	0.3480* (2.149)	-0.2204 (-0.851)	0.0207 (0.463)	0.0361 (0.171)	0.1323* (1.791)	-	0.0265
EHRW:	-0.0013 (-0.573)	0.5364** (5.569)	-0.1519 (-1.223)	-0.0276 (-1.334)	-0.0249 (-1.143)	-0.1885 (-1.251)	0.1478 (0.614)	0.5031** (3.163)	0.0315 (0.114)	-	0.0633 (0.922)	0.0308
Panel C: EARNINGS RESPONSE COEFFICIENTS COMPARISONS ^c (F-statistics and P-values)												
Hypotheses	WN	EHWN	Hypotheses				RW	EHRW				
H ₀ : UE = FORIS	0.2676 (0.605)	1.0580 (0.304)	H ₀ : UE = ΔFORIS				0.4922 (0.483)	0.0715 (0.789)				
H ₀ : UE = FORSE	4.8332* (0.028)	8.9572** (0.003)	H ₀ : UE = ΔFORSE				13.8099** (0.000)	15.7299** (0.000)				
H ₀ : FORIS = FORSE	1.7294 (0.188)	1.4729 (0.225)	H ₀ : ΔFORIS = ΔFORSE				4.8784* (0.027)	7.1280** (0.008)				

(Continued)

Table 5 (Continued)

^aThis panel reports the regression results from estimating the following two models:

$$\begin{aligned} \text{(WN) CAR}_i &= \gamma_0 + \gamma_1 \text{UE}_i + \gamma_2 D_{52} * \text{UE}_i + \gamma_3 \text{FORIS}_i + \gamma_4 D_{52} * \text{FORIS}_i + \gamma_5 \text{FORSE}_i + \epsilon_i \\ \text{(RW) CAR}_i &= \delta_0 + \delta_1 \text{UE}_i + \delta_2 D_{52} * \text{UE}_i + \delta_3 \Delta \text{FORIS}_i + \delta_4 D_{52} * \Delta \text{FORIS}_i + \delta_5 \Delta \text{FORSE}_i + e_i \end{aligned}$$

where D_{52} = dummy variable assuming a value of one in the Post-52 period, zero otherwise

Other variable definitions are provided in Table 4.

Model WN assumes a white noise expectations model for foreign currency gains or losses, while Model RW assumes a random walk expectations model. $N=1474$ for the white noise model and $N=1471$ for the random walk model.

^bThis panel reports the regression results from estimating the following two models:

$$\begin{aligned} \text{(EHWN) RRET}_i &= \kappa_0 + \kappa_1 \text{UE}_{11} + \kappa_2 D_{52} * \text{UE}_{11} + \kappa_3 \text{ADJEP}_i + \kappa_4 D_{52} * \text{ADJEP}_i + \kappa_5 \text{FORIS}_i + \kappa_6 D_{52} * \text{FORIS}_i + \kappa_7 \text{FORSE}_i + \xi_i \\ \text{(EHRW) RRET}_i &= \pi_0 + \pi_1 \text{UE}_{21} + \pi_2 D_{52} * \text{UE}_{21} + \pi_3 \text{ADJEP}_i + \pi_4 D_{52} * \text{ADJEP}_i + \pi_5 \text{FORIS}_i + \pi_6 D_{52} * \text{FORIS}_i + \pi_7 \Delta \text{FORIS}_i + \pi_8 D_{52} * \Delta \text{FORIS}_i + \pi_9 \Delta \text{FORSE}_i + \zeta_i \end{aligned}$$

Variable definitions are provided in Table 4.

Model WN assumes a white noise expectations model for foreign currency gains or losses, while Model RW assumes a random walk expectations model. $N=1474$ for the white noise model and $N=1471$ for the random walk model.

^cThis panel reports the results of the following F-test: $F = (\text{RSS}_R - \text{RSS}_U) / (\text{RSS}_U / (N-K))$

where RSS_R = the residual sum of squares from the regression which satisfies the null hypothesis $\gamma_i = \gamma_j$ ($\delta_i = \delta_j$, $\kappa_i = \kappa_j$, $\pi_i = \pi_j$)

RSS_U = the unrestricted residual sum of squares

N = number of observations

K = number of independent variables

* Significant at the 5% level, one-tailed test

** Significant at the 1% level, one-tailed test

$$\text{RRET}_i = \pi_0 + \pi_1 \text{UE}_{2i} + \pi_2 D_{52} * \text{UE}_{2i} + \pi_3 \text{ADJEP}_i + \pi_4 D_{52} * \text{ADJEP}_i + \pi_5 \text{FORIS}_i + \pi_6 D_{52} * \text{FORIS}_i + \pi_7 \Delta \text{FORIS}_i + \pi_8 D_{52} * \Delta \text{FORIS}_i + \pi_9 \Delta \text{FORSE}_i + \zeta_i \quad (10)$$

where:

D_{52} = dummy variable assuming a value of one in the Post-52 period, zero otherwise.

These expanded models are estimated over the combined Post-8 and Post-52 periods using the earnings announcement abnormal returns. Significant dummy interaction variables would indicate that the Post-8 coefficients are significantly different from the Post-52 coefficients (Johnston 1984, 227).

Panel A provides the results of estimating equations (7) and (8), while panel B gives the results for equations (9) and (10). Both white noise and random walk models are significant at less than the 1% level. Unexpected earnings (UE) are significantly positive for all models. FORIS and FORSE are significant under the white noise model, while only ΔFORIS is significant under the random walk model. ADJEP is negative and insignificant. These results are consistent with those reported in table 4.

In panel A of table 5, the dummy interaction variables for FORIS and ΔFORIS are insignificant at conventional levels. $D_{52} * \text{UE}$, however, is significantly negative for both earnings specifications. The result suggests that the market's valuation of non-foreign exchange ("other") earnings decreased after SFAS 52. We also reestimated the above models imposing the constraint that firms have an equal number of Post-8 and Post-52 observations (not reported). The dummy variables for FORIS and ΔFORIS continued to be insignificantly negative in all cases, while $D_{52} * \text{UE}$ remained significantly negative. Castanias and Griffin (1986) and Sheikholeslami (1992) find that relative to the pre-52 period, the post-52 adoption period experienced significantly greater analyst forecast volatility and error. If this is an indication of increased risk and uncertainty, it may explain why we find declines in earnings response coefficients (see, for example, Collins and Kothari (1989)).¹³

Panel B of table 5 shows that under the Easton and Harris specifications, the dummy variables for FORIS and ΔFORIS are still insignificant. $D_{52} * \text{UE}$ continues to be negative, but is no longer significant.

In panel C of table 5, we present the results of comparing the foreign exchange gain or loss coefficient (FORIS and ΔFORIS) with the coefficients for other unexpected earnings components under a random walk (UE_1) and white noise (UE_2) specification, respectively. This is accomplished using an F-test on the equality of each pair of coefficients (Johnston, 204-207). Regardless of specification, we find that the stock price response to foreign exchange gains and losses in income (FORIS) is not significantly different from the response to other earnings (F-statistics of 0.2676 and 1.0580 for the white noise models, and 0.4922 and 0.0715 for the random walk models, which are not significant at conventional levels).

In comparing the foreign translation gains and losses reported in stockholders' equity with other earnings, we find that in all models, the coefficient for the translation gains and losses is

¹³ Collins and Salatka (1993) find that earnings quality, as measured by total quarterly earnings response coefficients, improved under SFAS 52. Their results, however, were limited to a sub-sample of 12 firms that had only local currency foreign subsidiaries. For the remaining 15 multinational firms in their sample, no significant change in earnings response coefficients was found. To compare our results with those of Collins and Salatka, we conducted our tests using the 146 firms (representing 982 firm-year observations) with only local currency subsidiaries. $D_{52} * \text{UE}$ remained negative but was only marginally significant (t-statistic = -1.515, p-value = 0.065). Similar to Collins and Salatka, we also performed the test on the 30 firms (245 firm-year observations) with the highest variance of foreign currency gains and losses over the 1977-81 period. While $D_{52} * \text{UE}$ remained negative, it was no longer significant (t-statistic = -0.740, p-value = 0.460).

significantly smaller than the coefficients for the other components of earnings (F-statistics of 4.8332, 8.9572, 13.8099 and 15.7299, significant at the 5% level). Comparing the foreign translation gains and losses in stockholders' equity with the foreign exchange gains and losses in income, we find a statistically significant difference in coefficients for the random walk model (F-statistics of 4.8784 and 7.1280, significant at the 5% level), but the results under the white noise model are not significant.

V. Conclusions

Prior research generally has assumed that foreign translation gains and losses reported in income were used by the market to value equity securities, or that managers acted on this belief. We find evidence consistent with the market using foreign exchange gain and loss information reported in income under both the SFAS 8 and SFAS 52 regimes, and find no significant change in valuation weights between the two standards. The results also show that the foreign translation gain and loss information reported in stockholders' equity under SFAS 52 is utilized by the market. However, the earnings response coefficient for foreign translation gains and losses reported in stockholders' equity is significantly smaller than the coefficient for other earnings. This result suggests that foreign translation gains and losses should be reported separately from other earnings and from foreign transaction gains and losses.

Our results indicate that the market utilizes earnings information reported directly in stockholders' equity. The Financial Accounting Standards Board has recently broadened its practice of having firms report transitory gains and losses directly in stockholders' equity (e.g., unrealized gains or losses from debt and equity securities classified as "available-for-sale" (FASB 1993)). Future research may be directed at examining whether other gains and losses reported directly in stockholder's equity are similarly considered relevant by the market in valuing equity securities.

References

- Adler, M., and B. Dumas. 1983. International portfolio choice and corporation finance: A synthesis. *Journal of Finance* (June): 925–984.
- Arnold, J. L., and W. W. Holder. 1986. *Impact of Statement 52 on Decisions, Financial Reports, and Attitudes*. Morristown, NJ: Financial Executives Research Foundation.
- Beaver, W. H., and M. Wolfson. 1982. Foreign currency translation and changing prices in perfect and complete markets. *Journal of Accounting Research* (Autumn): 528–550.
- , and ———. 1984. Foreign currency translation gains and losses: What effect do they have and what do they mean? *Financial Analysts Journal* (March/April): 28–36.
- Belsley, D. A., E. Kuh, and R. E. Welsch. 1980. *Regression Diagnostics*. New York: John Wiley & Sons.
- Bowen, R. M., D. Burgstahler, and L. A. Daley. 1987. The incremental information content of accrual versus cash flows. *The Accounting Review* (October): 723–747.
- Castanias, R. P. III, and P. A. Griffin. 1986. The effects of foreign-currency translation accounting on security analysts' forecasts. *Managerial and Decision Economics* 7: 3–10.
- Cheng, C. S., W. S. Hopwood, and J. C. McKeown. 1992. Non-linearity and specification problems in unexpected earnings response regression model. *The Accounting Review* 67 (July): 579–598.
- Choi, F. D., H. D. Lowe, and R. G. Worthley. 1978. Accountors, accountants and Standard No. 8. *Journal of International Business Studies* 9 (Fall): 81–87.
- Collins, D. W., and S. P. Kothari. 1989. An analysis of intertemporal and cross-sectional determinants of earnings response coefficients. *Journal of Accounting and Economics* 11 (July): 143–181.
- , and W. K. Salatka. 1993. Noisy accounting earnings signals and earnings response coefficients: The case of foreign currency accounting. *Contemporary Accounting Research* 10 (Fall): 119–160.

- Cready, W. M., and P. G. Mynatt. 1991. The information content of annual reports: A price and trading response analysis. *The Accounting Review* (April): 291–312.
- Dukes, R. E. 1978. *An Empirical Investigation of the Effects of Statement of Financial Accounting Standards No. 8 on Security Return Behavior*. Stamford, CT: Financial Accounting Standards Board.
- Easton, P. D., and M. E. Zmijewski. 1993. SEC Form 10K/10Q reports and annual reports to shareholders: Reporting lags and squared market model prediction errors. *Journal of Accounting Research* (Spring): 113–129.
- , and T. S. Harris. 1991. Earnings as an explanatory variable for returns. *Journal of Accounting Research* 29 (Spring): 19–36.
- Evans, T. G., W. R. Folks Jr., and M. Jilling. 1978. *The Impact of Statement of Financial Accounting Standards No. 8 on the Foreign Exchange Risk Management Practices of American Multinationals: An Economic Impact Study*. Stamford, CT: Financial Accounting Standards Board.
- Fama, E. F. 1976. *Foundations of Finance*. New York, NY: Basic Books Inc.
- Financial Accounting Standards Board. 1975. *Statement of Financial Accounting Standards No. 8: Accounting for the Translation of Foreign Currency Transactions and Foreign Currency Financial Statements*. Stamford, CT: FASB.
- . 1976. *Statement of Financial Accounting Standards No. 14: Financial Reporting for Segments of a Business Enterprise*. Stamford, CT: FASB.
- . 1981. *Statement of Financial Accounting Standards No. 52: Foreign Currency Translation*. Stamford, CT: FASB.
- . 1993. *Statement of Financial Accounting Standards No. 115: Accounting for Certain Investments in Debt and Equity Securities*. Stamford, CT: FASB.
- Foster, T. W., III, D. R. Jenkins, and D. W. Vickery. 1986. The incremental information content of the annual report. *Accounting and Business Research* (Spring): 91–98.
- Francis, J., D. Pagach, and J. Stephan. 1992. The stock market response to earnings announcements released during trading versus nontrading periods. *Journal of Accounting Research* 30 (Autumn): 165–184.
- Freeman, R. N., and S. Y. Tse. 1992. A nonlinear model of security price responses to unexpected earnings. *Journal of Accounting Research* 30 (Autumn): 185–209.
- Garlicki, T. D., F. J. Fabozzi, and R. Fonfeder. 1987. The impact of earnings under FASB 52 on equity returns. *Financial Management* (Autumn): 36–44.
- Gilbert, L. R. 1989. The effect of SFAS 52 on earnings expectations. Ph.D. dissertation, Boston University.
- Givoly, D., and C. Hayn. 1992. The valuation of the deferred tax liability: Evidence from the stock market. *The Accounting Review* (April): 394–410.
- Griffin, P. A., and R. P. Castanias II. 1987. *Accounting for the Translation of Foreign Currencies: The Effects of Statement 52 on Equity Analysts*. Stamford, CT: Financial Accounting Standards Board.
- Houston, C. O. 1989. Foreign currency translation research: Review and synthesis. *Journal of Accounting Literature* 8: 25–48.
- Johnston, J. 1984. *Econometric Methods*. New York, NY: McGraw-Hill.
- Kim, H. 1985. An empirical study of the market reaction to Statement of Financial Accounting Standards No. 52: Foreign currency translation. Ph.D. dissertation, Indiana University.
- , and D. Ziebart. 1991. An investigation of the price and trading reactions to the issuance of SFAS No. 52. *Journal of Accounting Auditing and Finance* 6 (Winter): 35–52.
- Lipe, R. C. 1986. The information contained in the components of earnings. *Journal of Accounting Research* 24 (Supplement): 37–64.
- Makin, J. H. 1978. *Measuring the Impact of Floating and FASB Statement No. 8 on Costs of Capital for Multinationals. Economic Consequences of Financial Accounting Standards: Selected Papers*. Stamford, CT: Financial Accounting Standards Board.
- Rodriguez, R. M. 1980. *Foreign Exchange Management in U.S. Multinationals*. Lexington, MA: D.C. Heath.
- Salatka, W. K. 1989. The impact of SFAS No. 8 on equity prices of early and late adopting firms: An events study and cross-sectional analysis. *Journal of Accounting and Economics* (February): 35–70.

- Seidler, L. J., and P. A. McConnell. 1982. FASB Statement No. 52 on foreign currency translation: A first look. *Financial Analysts Journal* (Jan/Feb): 18–20.
- Shank, J. K., J. F. Dillard, and R. J. Murdock. 1979. *Assessing the Economic Impact of FASB No. 8*. New York, NY: Financial Executives Research Foundation.
- Sheikholeslami, M. 1992. A profile analysis of the predictability of accounting earnings numbers after FAS52. *Journal of Applied Business Research* 8: 31–35.
- Solnik, B. 1978. International parity conditions and exchange risk. *Journal of Banking and Finance* 2: 281–293.
- Warfield, T. D., and T. J. Linsmeier. 1992. Tax planning, earnings management, and the differential information content of bank earnings components. *The Accounting Review* (July): 546–562.
- White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* (May): 817–838.
- Ziebart, D., and D. Kim. 1987. An examination of the market reactions associated with SFAS No. 8 and SFAS No. 52. *The Accounting Review* (April): 343–357.

The Effects of Client Characteristics on Auditor Litigation Risk Judgments, Required Audit Evidence, and Recommended Audit Fees

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SYNOPSIS AND INTRODUCTION: Litigation risk is a significant and increasing concern for U.S. public accounting firms. Ernst & Young's recent \$400 million settlement with the FDIC is an indication of the magnitude of the problem facing the Profession. A recent survey conducted by the AICPA shows that malpractice insurance premiums for CPA firms other than "Big 6" have increased 300 percent since 1985, while deductibles have increased almost six times. Forty percent of those firms surveyed are "going bare" due to the high cost of liability insurance.¹ In addition, partners from Lavenethol & Horwath, previously the seventh largest accounting firm in the U.S., cited litigation claims against their firm in their decision to declare bankruptcy, and Palmrose (1988) notes that litigation against an audit firm can impair its reputation by providing a negative signal about the quality of the firm's audit services. In an effort to combat the increasingly litigious business environment, the "Big 6" recently issued a Statement of Position which has been distributed to audit clients, accounting faculty, state and federal legislatures, and members of selected government organizations.² In such an environment, it is important that auditors be

¹ Arthur Andersen et al. (1992, 3).

² Arthur Andersen et al. (1992).

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able to effectively screen potential clients and accurately assess litigation risks. Indeed, many accounting firms already appear to be more carefully screening new clients and rejecting some who, prior to the litigation explosion, would have been accepted.

The purpose of this study is to examine this screening process, and to determine whether auditor judgments of litigation risk and their recommendations for the preliminary audit plan and client fees are influenced by certain client characteristics that have been empirically related to audit litigation in the accounting literature. Specifically, we hypothesize that client financial condition, asset structure (proportion of receivables and inventory to total assets), sales growth, market value of equity, and variability in stock price returns relate to auditor judgments of litigation risk, to their recommendations for the amount of evidence required to reduce the risk of a material misstatement to an acceptable level, and to client fees. The hypotheses are tested in a field experiment where 243 audit partners and managers of four "Big 6" firms from offices throughout the U.S. were each asked to review a single case describing a prospective audit client, and then (1) assess certain elements of litigation risk associated with the engagement, (2) evaluate the financial condition of the client, and make recommendations for (3) the required amount of audit evidence and (4) client fees. Asset structure, sales growth, firm market value, and stock return variability were each assigned two levels (high/median) in the between-subjects experimental design, giving rise to 16 versions of the case which were distributed randomly across the subject sample.

The results indicate that the client's overall financial condition is the primary consideration in the auditor's assessment of litigation risk and recommendations for the audit plan and fees. Poorer financial condition was associated with higher levels of litigation risk, more audit evidence, and higher audit fees. The results for asset structure (receivables and inventory as a percentage of total assets) were generally consistent with the hypotheses and with the results for financial condition, though much weaker. Client market value and sales growth were generally unrelated to litigation risk, and the variability of the client's stock price was either ignored or viewed as relating negatively to litigation risk.

Additional tests suggest that audit fees reflect both the amount of audit evidence collected and an additional premium to cover litigation risks. That is, auditor assessments of a client's overall litigation risk explained a significant amount of the variance in audit fees over and above the amount explained by audit evidence, suggesting that auditors may be charging clients to insure against future litigation losses. The evidence does suggest, however, that the portion of the audit fee constituting the insurance premium is unrelated to the client characteristics examined in this study. Identifying the client characteristics that relate to the insurance premium may be an important area for future research.

In the next section, prior research is reviewed and its relationship to the design of the reported study is explained, followed by descriptions of the theoretical model and related hypotheses. The data collection and analysis procedures are then described, and the paper closes with a discussion of the results and implications.

Key Words: *Auditor litigation, Auditor judgments, Audit evidence, Audit fees, Client characteristics, Insurance hypothesis.*

Data Availability: *The data used in this study are available from the second author, and the experimental instrument is available from either author.*

I. Related Literature

Previous accounting research has addressed the issue of audit litigation by identifying problem areas that should be considered when performing audits (Schultz and Gustavson 1978; St. Pierre and Anderson 1984; Kellogg 1984). Stice (1991) extended this research by developing and testing a model to predict litigation against auditors, which includes both client and auditor characteristics. Client characteristics include financial condition, levels of accounts receivable and inventory, sales growth, market value of equity, and variability in the client's stock returns. Financial condition, levels of accounts receivable and inventory, and sales growth were predicted to affect the likelihood of an alleged audit failure and, in turn, subsequent litigation against the auditor. Market value of equity and the variability in the client's stock returns were predicted to relate positively to litigation by increasing the likelihood that the auditor would be the target of litigation. Auditor characteristics, which included auditor quality, independence, and tenure, were predicted to relate to litigation through their effects on the likelihood of an alleged audit failure.

Using a matched-pairs design on a sample of manufacturing firms matched on industry and time period, Stice (1991) found relatively strong and consistent support for the client characteristics and little support for the auditor characteristics. Financial condition was negatively related to litigation across all tests, while the levels of receivables and inventory, sales growth, stock price variability, and market value of equity were positively related to litigation in most cases. Auditor quality, independence, and tenure were normally not significant. He suggests that the model may be useful to practicing auditors by noting:

[Client characteristics associated with litigation] could aid auditors in assessing appropriate risk levels presented by clients. Auditors could then institute appropriate audit procedures to compensate for increased litigation risk and/or price their services to reflect the assessed level of litigation. (p. 532)

Additional accounting research indicates that audit firms consider litigation risk in the planning stages of the audit (Brumfield et al. 1983) and in the pricing of audit services (Simunic 1980; Francis 1984; Palmrose 1986; Simon 1985; Francis and Simon 1987; Simon and Francis 1988). As a result, previous research in the area has established two important links: (1) certain client characteristics are empirically related to litigation risk and (2) litigation risk is considered by auditors in the planning and pricing of audit services. Taken together, these two links imply that auditors should consider client characteristics when assessing litigation risk, planning audit procedures, and pricing audit services; especially those characteristics found in Stice (1991) to be related to litigation.

In this study, we limited the examination to client characteristics for two reasons. First, auditor characteristics are generally not significant in Stice (1991) and, second, it would be difficult for auditors to objectively recognize their own levels of quality and independence in their judgments about litigation risk, the audit plan, and client fees. In addition, to economize the design of our experiment we combined the levels of receivables and inventory into a single variable based on Francis and Simon (1987) and Simon and Francis (1988), who found this variable to be positively related to audit fees.

Finally, while the audit fee studies mentioned above identify a link between litigation risk and the pricing of audit services, their experimental designs do not allow one to determine whether

audit fees are (1) unrelated to audit effort, (2) reflect the level of audit effort only, or (3) reflect both the level of audit effort and a premium to insure against potential litigation. We used an experimental approach so that we could obtain measures of both audit effort and audit fees. This feature of our design enabled us to determine the relationship between client characteristics and audit effort, and control for audit effort while testing the relationship between litigation risk variables and audit fees.

II. Theory Development

In this section we first discuss a model of the audit judgment and decision process. Hypotheses are then developed by linking the client's financial condition, asset structure, sales growth, market value of equity, and stock return variability to different components of the model.

A Model of the Audit Judgment and Decision Process

Simunic (1980) developed a model identifying elements of the auditor's decision process when accepting an audit client. He states that, in a competitive market, audit fees will equal the auditor's expected costs as described in Equation (1):

$$E(C) = cq + E(d) * E(\phi) \quad (1)$$

Where,

$E(C)$ = total expected costs or the audit fee,

c = the per-unit factor cost of external audit resources to the auditor, including all opportunity costs and, therefore, including a provision for a normal profit,

q = the quantity of resources utilized by the auditor in performing the audit examination,

$E(d)$ = expected present value of possible future losses that may arise from auditing this period's financial statements, and

$E(\phi)$ = expected likelihood that the auditor will be held responsible for losses suffered relating to this period's financial statements.

In a competitive market, the auditor will perform the following procedures: (1) assess the amount of and likelihood of being held responsible for possible future losses, $E(d)*E(\phi)$; (2) invest in auditing, q , to the point where the marginal reduction in $E(d)*E(\phi)$ from an additional unit of auditing is equal to the marginal cost of that unit of auditing³; and (3) choose a client fee, $E(C)$, that covers the cost of the investment in auditing, including a normal profit, cq , and the expected value of possible future losses, $E(d)*E(\phi)$. Note that this process involves an auditor judgment (assessing $E(d)*E(\phi)$) and, based on that judgment, two audit decisions (choosing q and $E(C)$). The value of auditing to the auditor is measured in terms of the extent to which it reduces the auditor's exposure to possible future losses. If the auditor is unable to charge a fee sufficient to cover the total expected costs ($E(C)$), the option of withdrawing from the engagement is available.

From the auditor's perspective, a number of events associated with auditing this period's financial statements can cause possible future losses. Such events include, but are not limited to, sanctions by regulatory agencies, general industry-wide business failures (e.g., savings and loan

³ We assume that the auditor is constrained to provide at least the level of service determined by Generally Accepted Auditing Standards.

industry), and litigation, either threatened or filed, brought against the auditor by investors and creditors seeking to recover damages. While each of these activities are reflected in $E(d) \cdot E(\emptyset)$, the related losses generally manifest themselves through the initiation of legal action by investors and/or creditors.⁴ In the following discussion, possible future losses are defined as those losses associated with litigation, either threatened or filed, against the audit firm.

Litigation against the audit firm typically results when capital providers of an audit client incur an out-of-pocket loss large enough to initiate a search for recovery. The search may give rise to litigation (actual or threatened) involving the audit firm, including the allegation of an audit failure and an attempt to assign responsibility for the loss to the audit firm. The term, $\emptyset$, represents the likelihood that the audit firm will be deemed responsible for capital providers' losses, which may or may not be accompanied by a revealed audit failure. However, a revealed audit failure would certainly increase $\emptyset$.

This model provides a mechanism for predicting how client characteristics can affect the investment in auditing and the client's fee. Client characteristics that affect the expected cost of litigation should also affect the investment in auditing, and the recommended audit fee. Simunic (1980) and others (Francis 1984; Palmrose 1986; Simon 1985; Francis and Simon 1987; Simon and Francis 1988) provide evidence that auditors use an expected value model, similar to the one described above, when setting audit fees. In general, they show that the audit fee reflects possible future losses that may arise from the audited financial statements. Such "possible future losses" encompass both the expected dollar value of a probabilistic capital provider loss as well as the probability of the auditor being held responsible for the loss.

Hypotheses

We posit that auditors use the model developed in the previous section to assess the expected cost of litigation and to make preliminary recommendations for the audit plan and client fees. Auditor judgments and recommendations will be influenced, therefore, by client characteristics that relate to the parameters of the model. In this section we explain how the client's financial condition, asset structure, rate of sales growth, market value of equity, and variability in stock price returns relate to these parameters and, accordingly, determine auditor assessments of the expected cost of litigation and their recommendations for the preliminary audit plan and client fees. Note that we are not testing Simunic's model per se. Rather, we use it to motivate links between client characteristics and auditor litigation risk judgments and decisions.

Financial Condition and Litigation Risk. A client's financial condition is related to the probability of both capital provider losses and the auditor being held responsible for those losses. Palmrose (1987) and St. Pierre and Anderson (1984) observe a relationship between bankruptcies and lawsuits against auditors. Their results also indicate that in many cases where lawsuits are filed against auditors, client companies suffer significant losses without declaring bankruptcy. In addition, Stice (1991) argues that poor financial condition gives rise to future capital provider losses, which in turn lead to attempts to recover these losses through litigation against auditors. Thus, previous studies support the argument that a client's poor financial condition increases the likelihood of a loss being incurred by interested parties.

Kinney and McDaniel (1989) note that companies in weak financial condition are more likely to disguise problems through "window dressing," and Kreutzfeldt and Wallace (1986) found that companies with financial problems have significantly more financial statement errors than other companies. These two studies suggest that poor financial condition can readily lead to material misstatements that may be difficult to detect. Consequently, poor financial condition can lead to

⁴ Equity and debtholders are referred to as capital providers in the remainder of the paper.

more frequent audit failures. Considered together, the findings from prior research support the following hypotheses.

H1: Auditor evaluations of client financial condition will relate negatively to their judgments of (1) the probability of capital provider losses and (2) the probability of an audit failure.

Asset Structure and Litigation Risk. The relative importance of receivables and inventory on the client's balance sheet is related to the probability of an audit failure. SAS 47 as well as a number of empirical studies (e.g., see Simunic 1980; Ham et al. 1985; Willingham and Wright 1985; Kreutzfeldt and Wallace 1986; Francis and Simon 1987; and Simon and Francis 1988) suggest that receivables and inventory require subjective judgment in determining their values and, accordingly, are difficult and risky to audit. St. Pierre and Anderson (1984) note that nearly 50 percent of the errors related to the balance sheet are associated with either accounts receivable or inventory, and the financial press has identified a number of cases where management has intentionally overstated receivables and/or inventory, many of which have resulted in lawsuits against incumbent auditors.⁵

H2: The proportion of accounts receivable and inventory to total assets will relate positively to auditor judgments of the probability of an audit failure.

Rate of Growth and Litigation Risk. The rate of a client's growth in sales is related to the probability of an audit failure. High rates of sales growth can give rise to significant changes in both the revenue/receipt and expenditure/disbursement transaction cycles, which in turn can overburden the client's internal control system, reducing its ability to properly process transactions. Hylas and Ashton (1982) found that these two cycles account for almost half of the errors discovered by auditors, and Hall and Renner (1988) point out that the internal control systems of high-growth companies are often incapable of handling the transaction volume related to high sales growth, which can lead to material misstatements. Finally, frequent references in the financial press to fast-growing firms that have been associated with fraudulent management activities and subsequent audit litigation should make auditors increasingly aware of the litigation risks in such cases.⁶

H3: The client's rate of sales growth will relate positively to auditor judgments of the probability of an audit failure.

Market Value and Litigation Risk. The market value of the client's outstanding equity is related to the dollar value of an equityholder's potential loss. In a legal environment of class action suits and contingent legal fees, attorneys have incentives to pursue those cases where capital provider losses are largest. Kellogg (1984) found that the amount of damages incurred by plaintiffs, and subsequent claims against auditors, were strongly and positively related to firm value.

⁵ For example, see Stern, G. "Phar-Mor Fiasco Puts Shapira in Hot Seat" *The Wall Street Journal* (August 7, 1992), p. B1.

⁶ For example, see Stern, G. "Audit Report Shows How Far Chambers Would Go for Profits" *The Wall Street Journal* (October 21, 1992), p. A1. Note also that the hypothesis predicts that high sales growth indicates increased litigation risk because it puts pressure on a firm's control system, leading to reporting errors. High sales growth may also indicate strong financial condition, which in turn suggests low levels of litigation risk, and there is evidence that auditor interpretations of high sales growth are situation dependent (e.g., see Schick and Poneman 1993). In the test of this hypothesis described later, we address this problem by controlling for the firm's financial condition.

H4: The market value of the client's equity will relate positively to judgments of the probability of capital provider losses.

Variability of Stock Price Returns and Litigation Risk. Variability in the returns of the client's stock price is related to the probability of losses being incurred by equityholders. As variability increases, the probability that a stockholder will incur a significant loss also increases. Stice (1991) found that lawsuits against auditors correlate positively with the variance of residuals obtained from regressing daily returns from the client's equity securities against a market index for the six-month period preceding the period of the alleged audit failure.

H5: Variability in the returns of a client's stock price relate positively to judgments of the probability of capital provider losses.

Client Characteristics and Recommendations for Required Audit Evidence. Auditors will react to the additional litigation risk associated with poor financial condition, a high percentage of receivables and inventory to total assets, high sales growth, high market value of equity, and high stock price variability by recommending an increase in the resources invested in the audit. Additional audit evidence will be required to reduce the risk of a material misstatement to an acceptable level.

H6: Auditor recommendations for additional audit evidence will be associated with poor financial condition and high levels of receivables and inventory, sales growth, market value, and stock price variability.

Litigation Risk, Audit Evidence, and Audit Fees. No hypothesis is stated with respect to the determinants of audit fees. While we expect that audit fees will reflect both litigation risk and the amount of audit evidence collected, ex ante it is unclear whether litigation risk variables will explain variance in audit fees over and above that which is explained by audit evidence. In other words, we expect that audit fees will reflect the amount of audit evidence collected, but whether they reflect litigation risk unrelated to audit evidence is unclear. In this area we take an exploratory position.

III. Data Collection

The hypotheses were tested by asking managers and partners from four "Big 6" accounting firms to respond to a case that described a fictitious prospective audit client (Manufacture Incorporated). To gain their participation, we first contacted firm representatives who suggested that we follow certain procedures differing slightly across firms. Two of the firms provided a cover letter endorsing the project and encouraging support. The cover letters, along with copies of the case instrument, were then sent to specific partners located in major offices throughout the United States. For the remaining two firms, names and addresses for audit partners at major offices were obtained from the firm representatives. Case instruments were then sent to these individuals, including a cover letter from the researchers requesting support. Two hundred and forty three responses were received, comprised of 130 partners, 101 managers, and 12 who did not indicate a position. The sample was divided approximately evenly across the four firms.

While these procedures produced a large sample of audit partners and managers, we have no way of computing a response rate or assessing nonresponse bias. All four firms requested that they not be identified in the analysis and that no comparative analyses across firms be reported.

Prospective Audit Client Case

Each case contained three parts: (1) an introductory letter to the respondent, (2) information about a fictitious prospective client's operations, directors, management, predecessor auditor, financial statements and supporting footnotes, and relevant industry comparisons, and (3) questions asking the respondent to assess the client's litigation risk and financial condition, and to recommend certain elements of an audit plan and a client fee. The third section also contained questions about the exercise itself. The information contained in the second section was based on input obtained from a number of major U.S. accounting firms, each of which employs a systematic method of evaluating prospective audit clients. The content and format of the instrument was modeled after these methods. While much of the case information was condensed and summarized, and is in generic form, the case was constructed to appear as realistic as possible, and a number of audit partners from several "Big 6" firms participated in its development and pilot testing.⁷

Manipulated Variables

There are four manipulated variables (percentage of receivables and inventory to total assets, sales growth, market value of equity, and variability of stock price returns), each varied over two levels, giving rise to 16 different cases. Each case contains a set of audited financial statements (1988, 1989, and 1990), including a summary of significant accounting policies, and a subsection entitled RELEVANT INDUSTRY COMPARISONS. The levels of the four manipulated variables were determined by adjusting the industry statistics in this section. That is, all information, including the financial statements and accounting policies of the client, was held constant across the 16 cases, except for manipulations of the industry medians or norms.⁸

The asset structure manipulation (high/median) was achieved by varying the industry median so that the percentage of the client's receivables and inventory to total assets was either 50 percent above the industry median (30 percent of total assets vs. 20 percent of total assets) or equal to the industry median (30 percent of total assets vs. 30 percent of total assets). This manipulation also affected the industry medians for the current ratio, receivables turnover, and inventory turnover, which are also disclosed in this section of the case. The sales growth manipulation (high/median) was achieved by varying the industry median so that the client's sales growth was either three times the industry median (15 percent vs. 5 percent) or approximately equal to the industry median (15 percent vs. 14.8 percent). The market value of equity manipulation (high/median) was achieved by varying the industry median so that the market value of the client's equity was either well above the industry median (\$90 million vs. \$59 million) or approximately equal to the industry median. The variability in the stock price return manipulation (high/median) was achieved by stating in the text of this section that either "stock price fluctuations have significantly

⁷ Note in this study that we model audit judgments and recommendations by asking respondents to evaluate one of 16 cases, each of which contains one combination of the independent variable levels. This design characteristic differs from others in the audit judgment area (i.e., policy capturing area) who have used repeated-measure designs, where respondents evaluate a number of different combinations of the independent variable levels. Our approach was chosen to increase the realism of the task and to minimize demand characteristics, which are often a problem with repeated-measure designs (Pany and Reckers 1987). Also, Solomon and Shields (forthcoming) call for additional auditing studies that examine high-ranking audit decision makers under conditions that more closely capture the real world.

⁸ We chose to manipulate the industry norms instead of the financial statement themselves to achieve better experimental control. Since the statements are interrelated, manipulating them would have introduced a number of uncontrolled differences.

exceeded the industry norm” or “stock price fluctuations have been typical for the industry.” The remaining financial ratios disclosed in this section (debt/equity, return on equity, return on total assets, and price/earnings ratios) are constant for both the client and the industry across all 16 cases.⁹

Measured Variables: Financial Condition, Components of Litigation Risk, and Recommendations for Audit Evidence and Fees

Measures of financial condition, the components of litigation risk, and the recommendations for the amount of required audit evidence and audit fees were elicited in the third section of the case. Financial condition was measured by asking each respondent to assess on a 10-point scale (ranging from “much lower than normal” to “much higher than normal”) the client’s overall financial condition.¹⁰ The components of litigation risk were measured by asking each respondent to assess on a 10-point scale (ranging from “much lower than normal” to “much higher than normal”) “the likelihood that the stockholders and/or creditors of Manufacture would incur a loss large enough to motivate them to bring suit against your firm”¹¹ and “the likelihood that Manufacture’s financial statements would contain a material misstatement.” The recommended amount of required audit evidence was measured by asking the respondents to indicate “how much audit evidence must be collected to ensure that the risk of a material misstatement in the financial statements of Manufacture is reduced to an acceptable level.” Recommended audit fees were measured by asking the respondent “how large an audit fee would you recommend that Manufacture be charged for the audit, compared to a normal manufacturing client of similar asset

⁹ The overall levels of asset structure, sales growth, and market value, and the magnitudes of the differences between the high and low levels of these variables were determined by referring to Stice (1991), and observing (1) the levels of these variables in the sample of firms used in the empirical tests, and (2) the magnitude of the differences between the litigation and control groups. Because these levels and differences gave rise to significant differences in litigation against auditors in Stice’s empirical tests, we reasoned that auditors should be sensitive to differences of this magnitude. Thus, the experimental levels were set approximately equal to, and the differences were set slightly larger than, those found in Stice (1991). In the case of stock price variability, Stice (1991) used the variance in abnormal returns, which we chose not to use because we believe that most auditors are unfamiliar with that term. Instead, we noted that stock price variability either significantly exceeded, or was typical of, the industry norm. We judged that the phrase “significantly exceeded” should be sufficient to alert auditors to a potential litigation problem.

Further, after consulting auditing practitioners we chose to keep the combinations reasonable and believable by restricting the range of the manipulations from some level “above the industry norm” to “the industry norm.” We did not use “below the industry norm.” Wider ranges may have increased the power of our manipulations, but would have done so at the risk of introducing unrealistic combinations, and in certain cases litigation risk may relate to the extent to which a variable deviates from the industry norm, whether above or below it.

¹⁰ Note that financial condition was measured, instead of manipulated like the other independent variables. Manipulating financial condition would have been very difficult because (1) its determination is not objective and auditors would vary in their interpretations at any given level of the manipulation and (2) financial condition is not completely independent of the other independent variables, suggesting that certain combinations of financial condition with these other variables may be unrealistic (e.g., poor financial condition and high market value of equity or high sales growth).

Financial condition reflects the auditor’s judgments about the potential client as described in the basic case materials and the manipulated risk variables. To a large extent, the variability in assessments of financial condition across auditors appears to result from the variability in the individual abilities, experiences, etc. that they brought to the experiment.

¹¹ Note that this question, which is expressed in terms of a likelihood, is designed to provide a measure for the E(d) term in Simunic’s model, which is an expected dollar amount. The E(d) term represents an average of all possible losses associated with auditing the client, weighted by their respective probabilities. We judged that such a measure could not be used in this context because it would be impossible to enumerate and value all possible losses, and link them to their respective probabilities. As a result, we used this simpler measure that represents a reasonable surrogate for E(d) because it required the auditor to consider both the set of losses large enough to induce suits, and the probability of at least one of these losses occurring.

Table 1
Summary of Dependent and Independent Variables

<i>Dependent Variables</i>	<i>Experimental Question</i>
Probability of an Audit Failure *	...what is the likelihood that Manufacturer's financial statements would contain a material misstatement?
Capital Provider Losses *	...what is the likelihood that the stockholders and/or creditors would incur a loss large enough to motivate them to bring suit against your audit firm?
Audit Evidence *	...how much audit evidence must be collected to ensure that the audit of Manufacture is in accordance with GAAS?
Audit Fee *	How large an audit fee would you recommend that Manufacture be charged for the audit, compared to a "normal" manufacturing client of similar asset size?
<i>Independent Variables</i>	
Financial Condition *	Compared to a "normal" manufacturing client, assess Manufacture's overall financial condition.
Asset Structure	Manipulated (high/median)
Growth in Sales	Manipulated (high/median)
Market Value of Equity	Manipulated (high/median)
Stock Price Variability	Manipulated (signif. above norm/typical)

* Responses were provided on 10-point Likert scales ranging from (1) "much lower than normal" to (10) "much higher than normal."

size" on a 10-point scale (ranging from "much lower than normal" to "much higher than normal").¹² The four dependent and five independent variables are included in table 1.

IV. Data Analysis and Results

Preliminary data analysis included computing simple correlations among the five independent variables and among the four dependent variables. The correlations among the independent

¹² Note that subjects were not given the option of refusing the audit. In practice this option would be exercised if auditors believed that a client's litigation risk could not be sufficiently reduced through audit effort, or perhaps priced through additional audit fees. While this aspect of our design represents a scope limitation, it is unlikely that auditors would have refused any of the clients described in the experimental scenarios because the risk levels were rarely judged to be excessive.

variables are very low, and only one (Financial Condition/Asset Structure, $-.206$; $p = .01$) is statistically significant. Respondents associated lower percentages of receivables and inventory to total assets with higher levels of overall financial condition.

The correlations among Audit Failure, Capital Provider Losses, Audit Evidence, and Audit Fees, on the other hand, are all statistically significant at the .01 level, ranging from .418 to .624. These positive relationships are certainly not surprising in that higher probabilities of audit failure and capital provider losses are expected to be associated with greater amounts of required audit evidence and higher audit fees. These results are consistent with Simunic's model, which suggests that auditing is used to reduce the threat of litigation and audit fees are charged to cover investments in auditing and perhaps litigation risk.

While the correlations among the dependent variables are all significant, the shared variance is relatively low, ranging from .17 to .39, suggesting that each variable reflects a separate concept. This result allows us to treat each dependent variable separately in the main analysis, which is important because (1) most of the hypotheses draw a distinction between Audit Failure and Capital Provider Losses, and (2) separate measures of Audit Evidence and Audit Fees enable us to control for audit effort when we examine the relationship between litigation risk and audit fees.

Main Analysis and Results

The hypotheses were tested with a series of multiple regression models where one equation for each of the four dependent variables was estimated. The models involving Audit Failure, Capital Provider Losses, and Audit Evidence each contained five independent variables: the four manipulated variables entered as dummies and Financial Condition. The model involving Audit Fee contained these five independent variables as well as Audit Evidence. The tests used the data from all 243 respondents.¹³ The results are reported in table 2: Audit Risk Judgments (panel A) and Audit Recommendations (panel B). Both panels include the hypothesized sign for each independent variable, where appropriate, as well as the sign and significance level of each regression coefficient. The notation "NS" means that no relationship was hypothesized.¹⁴

Audit Failure. Financial Condition is significantly related ($p=.000$) to Audit Failure; Asset Structure is almost significant ($p=.121$); and the regression equation explains 14.6 percent of the variance ($p=.000$). Lower assessments of financial condition and perhaps higher levels of receivables and inventories as a percentage of total assets are associated with higher probabilities of audit failure. These results are generally consistent with the hypotheses, except for Growth in Sales, which is unrelated to assessments of Audit Failure.

Capital Provider Losses. Financial Condition is significantly related ($p=.000$) to Capital Provider Losses, as is Market Value of Equity ($p=.054$) and Stock Price Variability ($p=.080$), and the regression equation explains 11.1 percent of the variance ($p=.000$). Lower assessments of financial condition, higher levels of equity market value, and lower levels of stock price variability are associated with higher probabilities of capital provider losses. These results are

¹³ We also tested the hypotheses with four, 4-way ANCOVA models, one for each dependent variable. The four manipulated variables serving as independent variables and Financial Condition (and Audit Evidence in the case of Audit Fees) acting as a covariate. The results are virtually identical to those reported in the text of the paper.

¹⁴ Since the measured variables were constrained to fall between one and ten and the manipulated variables assumed one of two levels, there was limited possibility for extreme outliers or heteroscedasticity problems. Only two observations across all variables fell more than three standard deviations from the mean, and removing these observations from the analysis did not affect the results. Heteroscedasticity was also determined to be minimal by examining a plot of the residuals and noting that the variance was largely constant. Also, collinearity diagnostics (Green 1990) indicated very small to moderate multicollinearity, ranging from less than ten in the regressions for Audit Failure, Capital Provider Losses, and Audit Evidence to 20.9 in the regression for Audit Fees.

Table 2
Client Characteristics and Audit Risk Judgments and Recommendations:
Hypothesized Signs and Regression Results

Panel A: Audit Risk Judgments

	<i>Audit Failure</i>		<i>Capital Provider Losses</i>	
	<i>Hypothesized Sign</i>	<i>Coefficients (p-value)</i>	<i>Hypothesized Sign</i>	<i>Coefficients (p-value)</i>
Financial Condition	-	-.408 (.000)	-	-.297 (.000)
Asset Structure	+	.325 (.121)	NS	.211 (.303)
Growth in Sales	+	-.034 (.868)	NS	-.195 (.331)
Market Value of Equity	NS	.200 (.321)	+	.382 (.054)
Stock Price Variability	NS	-.084 (.677)	+	-.349 (.080)
Intercept		7.159		6.425
R squared		.146		.111
Regression F		8.013 (.000)		5.815 (.000)

Panel B: Audit Recommendations

	<i>Audit Evidence</i>		<i>Audit Fee</i>
	<i>Hypothesized Sign</i>	<i>Coefficients (p-value)</i>	<i>Coefficients (p-value)</i>
Financial Condition	-	-.227 (.000)	-.020 (.679)
Asset Structure	+	.282 (.077)	-.136 (.307)
Growth in Sales	+	-.102 (.510)	.162 (.210)
Market Value of Equity	+	.161 (.295)	.008 (.409)
Stock Price Variability	+	-.139 (.366)	-.106 (.409)
Audit Evidence			.612 (.000)
Intercept		6.914	2.166
R squared		.101	.383
Regression F		5.280 (.000)	23.987 (.000)

generally consistent with the hypotheses, except for Stock Price Variability. Contrary to prediction, auditors judged the probability of capital provider losses (and litigation risk) to be lower as the client's stock price variability rises.

Audit Evidence. Financial Condition ($p=.000$) and Asset Structure ($p=.077$) are significantly related to Audit Evidence, and the regression equation explained 10.1 percent of the variance ($p=.000$). Lower assessments of financial condition and higher levels of receivables and inventory as a percentage of total assets are related to the need to obtain additional audit evidence. While these two results are consistent with the hypotheses, this test failed to support the predicted relationships between Growth in Sales, Market Value of Equity, Stock Price Variability and Audit Evidence.

Audit Fee. Audit Evidence ($p=.000$) is the only variable significantly related to Audit Fees, and by itself explains approximately 38 percent of the variance ($p=.000$).¹⁵ Apparently, auditors addressed the increased litigation risk associated with low financial condition and high levels of receivables and inventory by increasing the required audit evidence, and increasing audit fees to cover the cost of acquiring this additional evidence. Fees did not appear to reflect a premium for the litigation risk associated with these variables.

Additional Analysis and Results

The previous analysis suggests that audit fees do not reflect a premium for the litigation risks associated with client financial condition, asset structure, growth in sales, market value of equity, and stock price variability. It is possible, however, that audit fees reflect a premium for litigation risks associated with other client characteristics, especially those indicating risks that cannot be reduced by collecting additional audit evidence. Menon and Williams (1994) show, for example, that stock prices indicate that investors are willing to pay a premium for the right to recover potential investment losses from auditors through litigation, noting:

“...it appears important for auditors to price their product to reflect this insurance service.” (p. 341)

Accordingly, we constructed a regression equation where Audit Fee served as the dependent variable, and a measure of the auditor's assessment of overall litigation risk (taken from the third section of the experimental case and indicated below) and Audit Evidence acted as the independent variables. We reasoned that audit fees would reflect a premium for litigation risk if Overall Litigation Risk explained a significant amount of the variance in Audit Fee over and above that which is explained by Audit Evidence.

Overall Litigation Risk¹⁶ - “...what is the likelihood that significant litigation would be brought against your firm as auditor of Manufacture?”

The results indicated on table 3 show that both Overall Litigation Risk and Audit Evidence are significant at $p=.000$, and the model explained over 42 percent of the variance.¹⁷ It appears,

¹⁵ To ascertain whether the client characteristics explained any variance in Audit Fees over and above the amount explained by Audit Evidence, squared partial correlation coefficients (SPCC) were computed for each of the independent variables. The SPCC measures the amount of variance in the dependent variable explained by a specific independent variable that is not explained by the other independent variables. The results show that the SPCCs for the client characteristics are all less than 1 percent, and statistically insignificant, while the SPCC for Audit Evidence is over 35 percent ($p < .001$).

¹⁶ Overall Litigation Risk was assessed on a 10-point Likert scale ranging from (1) “Much lower than Normal” to (10) “Much Higher than Normal.”

¹⁷ Squared partial correlation coefficients (SPCC) were again computed for each of the independent variables — Overall Litigation Risk and Audit Evidence, indicating that each variable explained a significant ($p < .001$) amount of the

Table 3
Audit Fees as a Function of Overall Litigation Risk and Audit Evidence

	<i>Audit Fees</i>	
	<i>Coefficients</i>	<i>p-values</i>
Overall Litigation Risk	.232	.000
Audit Evidence	.422	.000
Intercept	1.994	
R squared	.425	
Regression F	87.636	.000

therefore, that audit fee recommendations reflect a premium for certain kinds of litigation risks, but as the previous analysis shows, these risks do not seem to be reflected by the linear model of client risk characteristics examined in panel B of table 2.

To identify additional client characteristics that influenced the auditors' litigation risk judgments, the case instrument also asked respondents to list, in order of importance, up to four factors that affected their assessments of litigation risk. A list of the 12 most frequently mentioned factors, and the number of times each was mentioned, is provided in table 4. The factors that were either measured or manipulated in the case are indicated with an asterisk (*), and the others were held constant across all 16 cases.

Financial condition is clearly the most frequently mentioned item, which is consistent with the results of the main analysis, but note that many of the items listed were neither manipulated nor measured in this study. Note also that most of these items are non-financial, and it is possible that the litigation risk associated with them may be insensitive to the amount of auditing. This interpretation raises the possibility that Audit Fees, but not Audit Evidence, may reflect the perceived litigation risk associated with these characteristics. Unfortunately, our experimental design does not enable us to make such a determination, and we suggest that it could be a useful path for future research. That is, certain client characteristics may reflect litigation risk that can be reduced by additional auditing, which in turn increases audit fees. Other client characteristics may reflect litigation risk that cannot be reduced by additional auditing, but still lead to higher audit fees. To the extent that auditors price the risks associated with the second group of client characteristics, they may be charging clients a form of insurance premium for possible future litigation losses.

The relatively weak results reported earlier for Growth in Sales, Market Value of Equity, and Stock Price Variability raise questions about whether the experimental manipulations were sufficient to influence the litigation risk assessments of auditors who believe these variables to be important. We used the information reported in table 4 to conduct an additional test to address this question. We first identified those respondents who were in the high-level condition for either

variance over and above the other. Overall Litigation Risk explained almost 10 percent, and Audit Evidence explained almost 17 percent. Also, colinearity diagnostics suggested by Green (1990) were less than 20, indicating low levels of multicollinearity, and further analysis showed that outliers and heteroscedasticity did not present significant problems.

Table 4
Items Identified by Respondents as Affecting their Assessment
of Litigation Risk (N = 243)

<i>Rank</i>	<i>Item</i>	<i>Frequency</i>
1	Financial condition*	133
2	Background of management	91
3	Relationship with outside directors	78
4	Industry	67
5	Incentive compensation plan	58
6	Level of receivables and/or inventory*	54
7	Growth in sales*	50
8	Predessor's audit opinion	42
9	Debt amount and covenants	42
10	Market value of equity*	36
11	Accounting policies	30
12	Publicly traded	29

Growth in Sales or Market Value of Equity, and listed that variable as important in their assessments of litigation risk - 41 and 27 subjects for Growth in Sales and Market Value of Equity, respectively.¹⁸ We then matched each auditor in these two groups with a randomly-determined respondent who did not list a given variable, but was exposed to its high level condition. T-tests were then conducted comparing each group on the four dependent variable measures, and the results are contained in table 5.

The results are exactly in line with the hypotheses. High levels of sales growth are associated with a higher probability of audit failure, and recommendations for more audit evidence and higher audit fees, while high levels of market value are associated with a higher probability of audit failure, larger capital provider losses, and recommendations for more audit evidence and higher audit fees.¹⁹ This analysis suggests that the experimental manipulations for Growth in Sales and Market Value of Equity were large enough to influence the litigation risk assessments of auditors, who believed these variables to be important, in a manner that is consistent with the hypotheses. As noted in footnote 18, the same test could not be conducted for Stock Price Variability, which in turn suggests that determining the threshold at which client stock price variability influences auditor litigation risk assessments could be a topic for future research.

¹⁸ This same test could not be used for Stock Price Variability because very few auditors listed it as important to their litigation risk assessments. Also, a chi-square test of the independence of level of the independent variable and the explicit listing of that variable as being related to litigation risk (see table 4) results in $p=.00$ for Growth in Sales ($X^2=18.8, df=1$) and $p=.00$ for Market Value of Equity ($X^2=13.08, df=1$). Above-the-norm deviations appear to signal variables that are given closer scrutiny by auditors in their assessments of litigation risk.

¹⁹ Audit Evidence was not controlled for in the tests of the relationships between Growth in Sales and Market Value of Equity and Audit Fees.

Table 5
Significance Levels for t-tests Comparing Respondents Listing a Given Client
Characteristic with Respondents Not Listing the Characteristic

	<i>Audit Risk Judgments</i>		<i>Audit Recommendations</i>	
	<i>Audit Failure</i>	<i>Capital Provider Losses</i>	<i>Audit Evidence</i>	<i>Audit Fee</i>
<i>Growth in Sales (n=82)</i>				
Predicted Sign	+	NS	+	+
Significance Level	+ (.04)	+ (.17)	+ (.01)	+ (.06)
<i>Market Value of Equity (n=54)</i>				
Predicted Sign	+	+	+	+
Significance Level	+ (.04)	+ (.09)	+ (.01)	+ (.09)

V. Discussion and Implications

This study is useful to auditors because it describes and evaluates their judgments and decisions about litigation risk. Hogarth (1991, 278) notes:

[Judgment researchers] typically focus their work on three questions: (1) *how well* do people perform particular judgment tasks? (2) *how* do people perform particular judgment tasks? (3) how can you help people perform *better*.

With respect to question (2), the results suggest that auditors rely heavily on their assessments of a client's financial condition to assess litigation risk. They appear to use information contained in the financial statements, audited by other auditors, and associate poor financial condition with higher litigation risk.

This study also suggests that auditors consider a prospective client's asset structure in their judgments of litigation risk, and that sales growth and market value of equity are considered only by a subset of auditors. In those cases where significant differences were observed, high levels of receivables and inventory, equity market value, and sales growth were associated with high levels of litigation risk. There is very little support that auditors consider the variability in a client's stock price when assessing litigation risk.

With respect to question (1), the evidence is mixed. To assess the quality of the auditor judgments, we used the criterion that auditors should not only react to those client characteristics that have been shown to relate to litigation against auditors, but they should act in a manner that is consistent with the direction in which the characteristic relates to litigation. The results show that auditors generally met this criterion only for the prospective client's financial condition and asset structure. In the cases of sales growth and market value of equity, only a subset of auditors (those who listed these variables as important) appeared to have met this criterion, and for stock price variability the criterion was not achieved.

With respect to question (3), the remedy for improving auditor judgments in this area may involve training, decision aids, and/or framing litigation risk judgments in ways that increase the auditor's awareness of (i.e., make more salient) the importance of client sales growth, market

value of equity, and stock price variability in the determination of litigation risk. Perhaps framing prospective client evaluation forms to emphasize the relationship between these financial statement variables and industry norms can encourage auditors to consider them more closely as they assess litigation risk. On the other hand, very few auditors appeared to recognize the importance of stock price variability, even though half of the sample was exposed to its high condition. This finding suggests that auditors may be unaware that this variable relates to litigation and, accordingly, training may provide a more effective solution.

This study also showed that auditor behavior, in the form of recommendations for the audit plan and audit fees, is influenced by client characteristics. Lower levels of financial condition, higher levels of receivables and inventory to total assets, and (for a subset of auditors) higher levels of sales growth and market value of equity encouraged the collection of additional audit evidence, which in turn led to higher audit fees.

Additional analyses also suggests that litigation risk is reflected in the recommended audit fee. The litigation risk associated with client financial condition and asset structure led to additional auditing, which in turn led to higher recommended fees. Recommended audit fees also appeared to reflect the cost of litigation risk over and above the cost of collecting additional audit evidence, suggesting that audit fees may include a premium for some form of investor insurance. Menon and Williams (1994) suggest that audit fees should reflect such a premium because investors price securities in a way that manifests the right to recover potential investment losses through auditor litigation. These findings should be considered in light of anecdotal evidence from auditors that litigation risk cannot be passed on to clients in the form of higher fees, which underlies many of the recent efforts by the accounting profession to reform legislation related to auditor liability (e.g., see Arthur Andersen et. al, 1992).

The experimental setting of this study, however, was limited in that the auditors were simply asked to recommend an audit fee, and there were no competitive pressures to control fees. Such pressures may reduce, or even eliminate, the litigation insurance portion of the audit fee. In addition, the auditors were not allowed to withdraw from the engagement, and the levels of litigation risk were generally moderate. Further, we examined only a limited number of client characteristics and the experimental design contained no economic incentives for the auditors to make accurate judgments and judicious decisions. Studies addressing how auditors respond to highly risky clients, other client characteristics, and/or the economic incentives surrounding the auditor litigation risk judgments could be subjects for future research.

References

- Andersen, Arthur, Coopers & Lybrand, Deloitte & Touche, Ernst & Young, KPMG Peat Marwick, and Price Waterhouse. 1992. The liability crisis in the United States: Impact on the accounting profession. *Statement of Position* (August 6).
- Brumfield, C., R. Elliott, and P. Jacobson. 1983. Business risk and the audit process. *Journal of Accountancy* 155 (April): 60-68.
- Francis, J. 1984. The effect of audit firm size on audit prices: A study of the Australian market. *Journal of Accounting & Economics* 6 (February): 133-151.
- Francis, J., and D. Simon. 1987. A test of audit pricing in the small-client segment of the U.S. audit market. *The Accounting Review* 62 (January): 145-157.
- Green, W. H. 1990. *Econometric Analysis* NY: Macmillan.
- Hall, W., and A. Renner. 1988. Lessons that auditors ignore at their own risk. *Journal of Accountancy* 166 (July): 50-58.
- Ham, J., D. Losell, and W. Smieliauskas. 1985. An empirical study of error characteristics in accounting populations. *The Accounting Review* 60 (July): 387-406.

- Hogarth, R. 1991. A perspective on cognitive research in accounting. *The Accounting Review* 66 (April): 277-290.
- Hylas, R., and R. Ashton. 1982. Audit detection of financial statement errors. *The Accounting Review* 57 (October): 751-65.
- Kellogg, R. 1984. Accounting activities, security prices, and class action lawsuits. *Journal of Accounting & Economics* 6 (December): 185-204.
- Kinney, W., and L. McDaniel. 1989. Characteristics of firms correcting previously reported quarterly earnings. *Journal of Accounting & Economics* 11 (February): 71-93.
- Kreutzfeldt, R., and W. Wallace. 1986. Error characteristics in audit populations: Their profile and relationships to environmental factors. *Auditing: A Journal of Practice & Theory* 6 (Fall): 20-43.
- Menon, K., and D.O. Williams. 1994. The insurance hypothesis and market prices. *The Accounting Review* 69 (April): 327-342.
- Palmrose, Z. 1986. Audit fees and auditor size: Further evidence. *Journal of Accounting Research* 24 (Autumn): 97-110.
- . 1987. Litigation and independent auditors: The role of business failures and management fraud. *Auditing: A Journal of Practice & Theory* (Spring): 90-102.
- . 1988. An analysis of auditor litigation and audit service quality. *The Accounting Review* 63 (January): 55-73.
- Pany, K., and P. Reckers. 1987. Within- vs. between-subjects experimental designs: A study of demand effects. *Auditing: A Journal of Practice & Theory* 7 (Fall): 39-53.
- Schick, A. G., and L. A. Poneman. 1993. The Influence of Auditors' Perceptions of Organizational Decline on Audit Risk. *Organizational Science* (February): 92-107.
- Schultz, J., and S. Gustavson. 1978. Actuaries' perceptions of variables affecting the independent auditor's legal liability. *The Accounting Review* 53 (October): 626-641.
- Simon, D. 1985. The audit services market: Additional empirical evidence. *Auditing: A Journal of Practice & Theory* 5 (Spring): 71-78.
- , and J. Francis. 1988. The effects of auditor change on audit fees: Tests of price cutting and price recovery. *The Accounting Review* 63 (April): 255-269.
- Simunic, D. 1980. The pricing of audit services: Theory and evidence. *Journal of Accounting Research* 18 (Spring): 161-190.
- Solomon, I., and M. Shields. forthcoming. Judgment and decision making research in auditing. In *Judgment and Decision Making Research in Accounting*, edited by A. Ashton and R. Ashton. New York, NY: Cambridge University Press.
- St. Pierre, K., and J. Anderson. 1984. An analysis of the factors associated with lawsuits against public accountants. *The Accounting Review* 59 (April): 242-263.
- Stern, G. 1992. Phar-Mor fiasco puts Shapira in hot seat. *The Wall Street Journal* (August 7): B1.
- . 1992. Audit report shows how far Chambers would go for profits. *The Wall Street Journal* (October 21): A1.
- Stice, J. 1991. Using financial and market information to identify pre-engagement factors associated with lawsuits against auditors. *The Accounting Review* 66 (July): 516-533.
- Willingham, J., and W. Wright. 1985. Financial statement errors and internal control judgments. *Auditing: A Journal of Practice & Theory* 5 (Fall): 57-70.

Market Reaction to Earnings Announcements of Successful Efforts and Full Cost Firms in the Oil and Gas Industry

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SYNOPSIS AND INTRODUCTION: From time to time over the last 25 years, the Accounting Principles Board (APB), the Financial Accounting Standards Board (FASB) and the Securities and Exchange Commission (SEC) have debated whether successful efforts (SE) or full cost (FC) accounting provides investors (creditors) with the more informative accounting numbers and thus should be mandated for all oil and gas firms.¹ (See Deakin 1989 and Collins, Rozeff and Salatka 1982, for a description of regulatory events surrounding the SE versus FC controversy.) This debate is related to the notion of "quality of earnings" which has received some attention both in the popular press (Donelly 1990; O'Glove 1987) and in the academic accounting literature (Collins and Salatka 1993 on foreign currency accounting; Pincus and

¹ Under FC accounting, all costs incurred in acquiring, exploring and developing properties, including the cost of dry wells, are capitalized. In SE accounting, only costs of successful exploratory wells are capitalized and the costs of dry exploratory wells are expensed. The essential features and conceptual merits of SE and FC accounting have been discussed in Klingstedt (1970), FASB (1977) and Lilien and Pastena (1981). Within each method a variety of applications exist, depending on which costs are capitalized and at what point they are transferred to cost pools that are subject to amortization. The issuance of ASR No. 257, 258, Regulation S-X 210:4-10 and SAB#47 by the SEC, which prescribed the forms of SE/FC accounting to be adopted by oil and gas firms, narrowed significantly these intra-method differences. However, oil and gas firms do not normally disclose details of these applications other than stating that they use either the SE or the FC method.

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Wasley 1992 on Lifo/Fifo; and Carroll, Collins and Johnson 1993 on Lifo/Fifo). Results from the academic literature suggest that certain accounting procedures appear capable of producing superior quality earnings numbers which are highly valued (priced) by the market, while some other accounting procedures are not. The current study provides further insight into the potential effects of accounting policy choice on earnings quality by examining whether SE and FC earnings are priced differently by the market.

Despite the regulatory interest in the quality of SE versus FC accounting, there is relatively little evidence on whether investors evaluate SE and FC accounting numbers differently. Harris and Ohlson (1987) found that SE firms exhibit higher market-to-book coefficients than FC firms, a result consistent with Sunder's (1976) finding that the SE method produces more conservative net assets and income numbers than the FC method. Ayres and Rayburn (1991) regress annual security returns on annual earnings changes and supplemental reserve information variables for SE and FC firms and find that SE firms have higher coefficients on the earnings change variable than FC firms. This study provides evidence on the quality issue by comparing the earnings response coefficients (ERCs) of SE and FC firms surrounding their quarterly earnings announcement dates over the 1982–1990 period. Short event windows are selected for analysis to accentuate SE versus FC effects: timing differences between accounting numbers related to different methods of cost recognition (such as SE and FC) tend to decline over longer horizons.

Predictions are based on Ramakrishnan and Thomas' (1992) argument that the FC method imparts considerable price-irrelevant elements to earnings by capitalizing and amortizing exploration costs associated with dry holes (which have no future cash flow generating ability). SE accounting's immediate recognition of dry hole costs occurs in the same period in which the market would react to the information about the unproductive exploration activity. This is consistent with SE earnings being viewed as better quality earnings than FC earnings. According to this view of earnings quality, a high quality earnings number is generated when valuation relevant events are recognized in the same fiscal period in which they are recognized in returns (see, for example, Lev 1989). This notion of earning quality also implies that SE ERCs are likely to be larger than FC ERCs.

The main finding of the study is that SE ERCs are, on average, greater than FC ERCs over the entire sample period. Unlike some prior studies, empirical tests in this paper control for the potentially confounding effects of exploration activity, growth, risk, earnings predictability and earnings persistence on ERCs. Ayres and Rayburn (1991), who found long-window SE ERCs to be larger than FC ERCs, control for potential risk and size effects but not for other factors; Spear (1993) also does not examine the effects of potentially confounding factors in his research design.²

However, the main finding is sensitive to time-partitions. SE ERCs, on average, exceed FC ERCs during 1982–1985 but not during 1986–1990. The latter period is one of relative decline in the level of exploration activity due to a dramatic oil price decline in 1986. The consequent drop in exploration activity led to the examination

² Spear (1993) finds that the market reacted more favorably to accrual changes than cash flow changes of FC firms but was neutral between SE firms' accrual changes and cash flow changes.

of time partitions because differences across SE and FC numbers are accentuated when the level of exploration activity is high.

It is interesting to observe that FC firms have smaller ERCs despite having, on average, the same persistence in their reported earnings as SE firms. This apparent puzzle is again explained in the analysis of Ramakrishnan and Thomas (1992). FC firms achieve persistence in their reported earnings series by deferral and amortization of dry hole costs which are price-irrelevant in periods subsequent to the outlay. In effect, one observes the persistence of accounting accruals rather than persistence that reflects cash flows. The ERC results support the notion that the market attaches no value to persistence created by accounting accruals. In the context of Ramakrishnan and Thomas' (1992) analysis, ERCs increase in persistence only when that persistence reflects underlying economic characteristics (i.e., cash flow effects).

Key Words: *Successful efforts, Full cost, Earnings response coefficients, Quality of earnings.*

Data Availability: *A list of sample firms is available upon request.*

THE remainder of the paper is organized as follows. The sample and research design are described in section I. Empirical models and results of empirical tests are discussed in section II. Some alternative explanations are examined in section III. The paper ends with a summary and conclusions in section IV.

I. Sample and Research Design

Empirical tests are carried out by regressing abnormal returns around quarterly earnings announcements on unexpected earnings of sample firms over the 1982–1990 period. The following criteria were used to select the sample firms: (i) quarterly earnings per share forecasts were available for oil and gas firms classified as either “Petroleum (Integrated)” or “Petroleum (Producers)” in edition 3 and edition 12 of the Value Line Investment Survey, respectively, over the 1982–1990 period; (ii) annual reports for the firms between 1982 and 1990 were available in microfiche at the University of Iowa Business Library; (iii) the firms were included in COMPUSTAT tapes; and (iv) security returns data were available from the CRSP tape.

The initial sample consisted of 49 Value Line “Integrated” and 30 “Producer” firms. Application of the second criteria yielded 28 “Integrated” firms and 12 “Producer” firms. An examination of the annual reports indicated that one “Integrated” firm did not have any oil and gas exploration activity during the sample period and that firm was dropped from the sample, reducing the sample to 39 oil and gas firms with 959 quarterly unexpected earnings observations. Missing Value Line beta and Value Line earnings predictability figures (coded “NMF” by Value Line) reduced the number of quarterly observations to 926. Application of the third criterion reduced the sample to 870 quarterly observations because of missing quarterly earnings announcement dates on the COMPUSTAT quarterly tapes. The total number of SE and FC quarterly observations available for estimating empirical models are 541 and 329, respectively, for the 39 firms. Twenty of these firms use SE and 15 firms use FC. Of the remaining firms, one switched from SE to FC and another three switched from FC to SE between 1982 and 1990.

The following discussion first examines how certain attributes of the unexpected earnings variable might influence the difference between SE and FC ERCs. This is followed by an

examination of firm specific characteristics which might also affect the difference between ERCs of SE and FC firms. These characteristics (control variables) are exploration activity, growth, risk, earnings predictability and earnings persistence, and they must be controlled for in empirical tests of the hypothesized ERC effects.

Unexpected Earnings. Measurement error in unexpected earnings in ERC regressions biases the ERC towards zero and thus needs to be controlled for in empirical tests. Systematically different forecasting horizons, LAG, (measured as the number of days between the analysts' forecast date and the earnings announcement date), between SE and FC firms could impart diverse amounts of measurement error in Value Line analysts' earnings forecasts when used as a proxy for expected earnings just prior to earnings announcements. Oil and gas sample firms are classified as either 'Integrated' (edition 3 of Value Line) or 'Producers' (edition 12) by Value Line. Since Value Line uses a staggered cycle to release editions, the mean LAG score for SE firms is 19 days, which is significantly smaller than the mean LAG score of 37 days for FC firms during 1982–1990. In order to control for measurement error in unexpected earnings arising from stale forecasts, the following regression model is estimated for the entire sample period.³ (t-statistics are reported in parentheses.)

$$E_{iq}/P_{t-2} = 0.002 + 0.827 F_{iq}/P_{t-2} + 0.024 RVL_{iq} - 0.004 LAG_{iq}/P_{t-2} + UE_{iq} \quad (1)$$

(0.563) (13.459) (0.952) (-4.876)

$$\text{Adj } R^2 = 0.32$$

where,

- E_{iq} = actual earnings per share for firm i in quarter q as reported by Value Line.
- F_{iq} = most recent Value Line earnings per share forecast for firm i for quarter q .
- RVL_{iq} = cumulative abnormal returns from the most recent Value Line earnings forecast date through two days prior to the earnings announcement date of firm i for quarter q .
- LAG_{iq} = the forecasting horizon, measured by the number of days between the most recent Value Line earnings forecast date and the earnings announcement date for firm i for quarter q .
- P_{t-2} = stock price of firm i two days prior to the earnings announcement date for quarter q .
- UE_{iq} = the error term in the regression and the *unexpected earnings*.

In equation (1), RVL_{iq} proxies for the information available to the market from the analysts' earnings forecast date till two days prior to the earnings announcement date (i.e., just prior to the event window). The fitted values of equation (1) serve as estimates of the market's expectation of earnings just prior to the event (earnings announcement) window.⁴

The distributions of UEs of SE and FC firms are significantly different from one another. The mean (standard deviation) UE is .002 (.014) for SE and -0.004 (0.114) for FC firms ($t=1.032$). The first, second (the median) and third quartile UE figures are -.000, .003 and .007 for SE and -.000, .011 and .022 for FC firms. The Kruskal-Wallis Chi-square statistic of 69.97 rejects the null of no difference between the distributions of UEs of SE and FC firms at the $p<.01$ level. The quartile figures above indicate that UEs of FC firms tend to be larger and also more variable than those

³ I am grateful to the associate editor for suggesting this method.

⁴ Equation (1) is also estimated (i) for SE observations only and (ii) for FC observations only, to examine the robustness of (a) the insignificant results for the RVL variable and (b) the high adjusted R^2 in equation (1) to different data partitions. The RVL variable is not significant in either of the regressions and the adjusted R^2 s are 0.75 and 0.27, respectively.

of SE firms. These differences could arise from the greater riskiness of FC firms and their relative lack of diversification as compared to SE firms (see later discussion). Therefore, earnings of FC firms appear to be harder to predict than those of SE firms, because UEs of FC firms are observed to be larger and more variable than those of SE firms. Differences in magnitude and volatility of UEs of SE versus FC firms might cause FC UEs to be less value-relevant than SE UEs (Freeman and Tse 1992) regardless of any SE/FC accounting method effects. This issue is analyzed in greater detail later.

Control Variables

Time-period Partition. Descriptive statistics for the control variables are reported for SE and FC firms in table 1. Statistics are presented separately for 1982–1985 and 1986–1990 because these two time periods presented different production, financing and investment opportunities to oil and gas firms. The 1982–1985 period was one of relatively high oil prices. Crude oil prices fluctuated between \$28 and \$35 per barrel during that time. On the other hand, 1986–1990 was a period of low oil prices fluctuating between \$10 and \$20 per barrel. The Hughes Rig Count (of active rotary drilling rigs in the USA), a measure of the exploration activity level in the oil and gas industry, also declined dramatically during 1986–1990 as compared to 1982–1985 (see figures 1 and 2).

Exploration activity of the sample firms also declined in 1986–1990 relative to 1982–1985. The proxy used to capture the extent of exploration activity is the dollar amount of exploration costs expressed as a percentage of total revenues (hereafter EXPL). The average EXPL score of SE firms declined from 4.7% in 1982–1985 to 2.5% in 1986–1990 ($t=3.23$, $p<.01$, two-tailed). The corresponding figures for FC firms were 9.8% in 1982–1985 and 6.0% in 1986–1990 ($t=1.74$, $p<.10$, two-tailed).^{5 6}

The SE and FC methods define two alternative ways of amortizing oil and gas *exploration costs* against total revenues, so the lower the amount of exploration costs of a firm as a percentage of total revenues (i.e., the lower is the EXPL score), the less its net income is likely to be affected by this accounting choice. Because EXPL scores declined significantly for sample firms during 1986–1990 relative to 1982–1985, the net income effect of an SE vs. FC method difference is also likely to be less during 1986–1990.⁷ Thus, the effect of an SE vs. FC choice on ERCs is also likely to be smaller during 1986–1990 as compared to 1982–1985. For these reasons, empirical tests are carried out separately for 1982–1985 and 1986–1990.

Growth Opportunities. Collins and Kothari (1989) provide evidence that ERCs are positively related to growth opportunities. The proxy for growth is $E(\text{capX})$, Value Line analysts' forecast

⁵ Three other proxies of exploration activity were analyzed, namely, exploration costs as a percentage of oil and gas revenues, exploration costs plus development costs as a percentage of total revenues and exploration costs plus development costs as a percentage of oil and gas revenues. Consistent with the distribution of EXPL scores, all these variables exhibit significant declines from 1982–1985 to 1986–1990 for both SE and FC firms. Exploration cost data were obtained from supplemental disclosures under paragraph 21 (b) of SFAS No. 69 which requires firms to disclose their annual exploration costs regardless of whether they are capitalized or charged to expense.

⁶ These results show that consistent with Deakin (1979), FC firms have a greater commitment to exploration than SE firms.

⁷ A decline in exploration activities would cause an immediate reduction in SE expenses, but is likely to have little effect on FC amortization expenses in the short run. If the drop in SE expenses is not fully offset by the reduction in revenues arising from falling oil prices, SE earnings would rise in the short run. Since FC amortization expenses are not likely to change in the short run, the decline in revenues would cause FC earnings to fall. Thus, a contraction in exploration activities, accompanied by falling oil prices, tends to narrow the difference between SE and FC earnings because under high growth (exploration) conditions (which prevailed during 1982–1985), FC earnings tend to exceed SE earnings (Sunder 1976).

Table 1
Differences in Control Variables Between SE and FC Firms

Period	Firm years of observation	EXPL		E(capX)		INV/INV _{t-1} ^a		SUCCESS		BETA ^b		EPRED ^b	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
1982 - 1985													
	70	0.047	0.029	0.394	0.347	0.983	0.988	0.824	0.588	1.189	1.188	52	55
	60	0.098	0.044	0.321	0.244	1.251	0.989	1.319	0.952	1.363	1.400	31	28
	t-statistics	3.10*		0.94		1.09		3.07*		6.05*		6.68*	
	Kruskal-Wallis												
	Chi-Sq	1.75		2.37		0.00		12.75*		30.73*		33.95*	
1986 - 1990													
	79	0.025	0.021	0.213	0.189	0.929	0.875	0.633	0.545	0.962	0.950	44	45
	32	0.060	0.024	0.185	0.180	1.055	0.825	0.971	0.969	1.042	1.025	32	30
	t-statistics	2.22**		0.85		1.08		3.52*		2.49**		3.53*	
	Kruskal-Wallis												
	Chi-Sq	0.65		0.23		0.19		13.58*		6.93*		11.18*	

EXPL is the ratio of exploration costs to total revenues. E(capX) is Value Line forecasted next year's capital expenditure (made just prior to end of current year) divided by beginning of year market value of equity. INV_t is Value Line reported capital expenditure in year t divided by beginning of year market value of equity. SUCCESS is the ratio of net change in the standardized measure of discounted future net cash flows due to extension, discoveries and improved recoveries less related costs divided by the sum of exploration costs and development costs. BETA is Value Line beta. EPRED is Value Line reported earnings predictability. Significance levels (two-tailed): * < 0.01, ** < 0.05, *** < 0.10. T-statistics and Kruskal-Wallis Chi-Square statistics report the results of the test of the null hypothesis that the distribution of the variables for SE and FC firms are equal against the alternative that the distribution of the SE variables and FC variables are not equal.

a: there are no 1982 observations for this variable; empirical tests are based on 49 SE and 42 FC firm years during 1982-1985.

b: tests are based on annual averages for these variables.

Figure 1
Crude Oil Prices
(\$ per barrel)

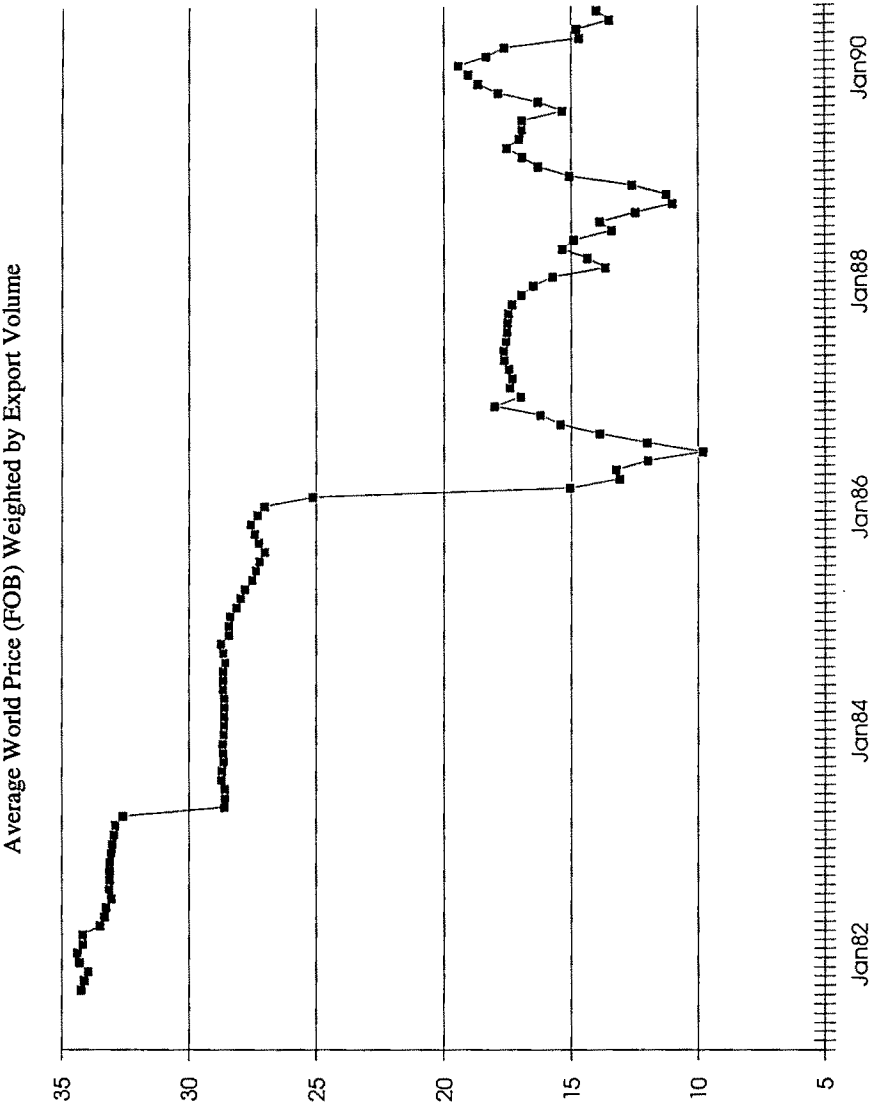
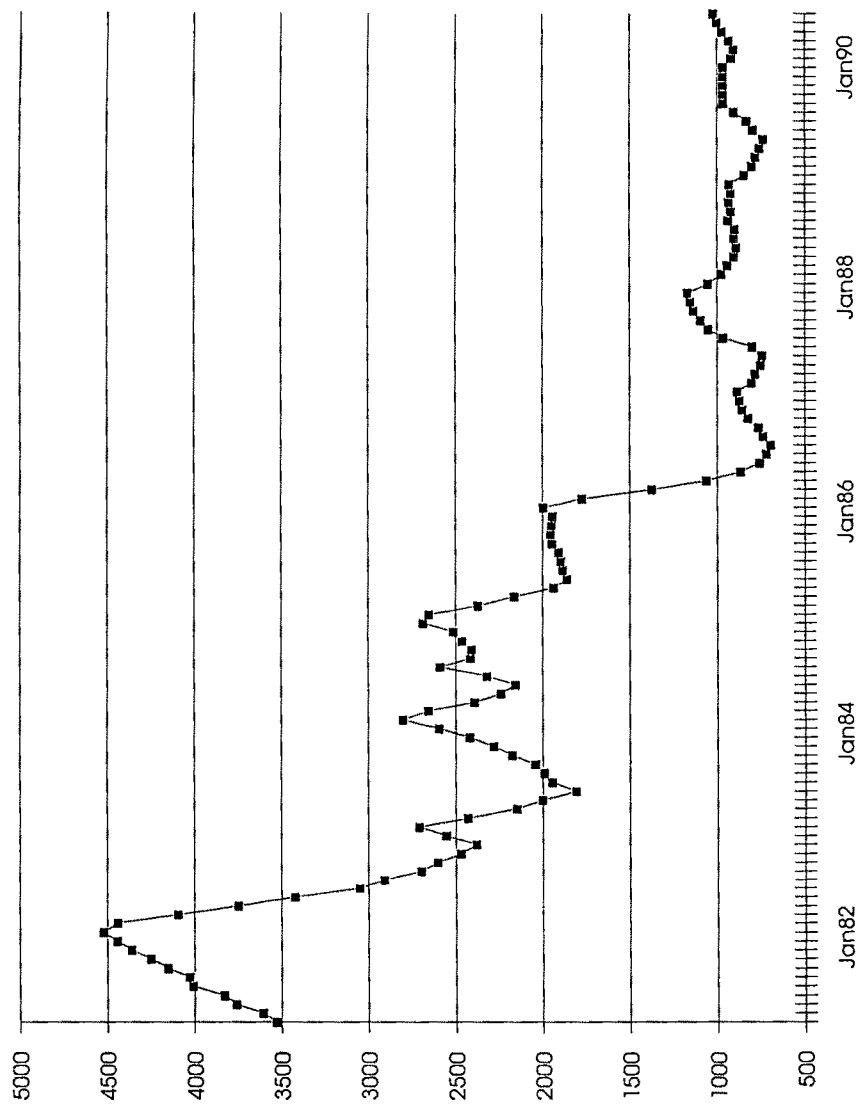


Figure 2
Hughes Rig Count
(Number of Active Rotary Rigs)



Source: Oil and Gas Journal

of next year's capital expenditure (divided by beginning of period market value of equity).⁸ SE and FC firms do not differ in their overall growth potential because $E(\text{capX})$ scores are not significantly different between these two groups of firms in either subperiod (see table 1).⁹

SE and FC firms earned different proportions of their total revenues from oil and gas producing activities during the sample period. For example, SE firms, on average, earned only 35% and FC firms only 59% of their total revenues from oil and gas producing activities during 1982–1985. These proportions indicate that SE firms are probably more diversified than FC firms. The average proportions further declined to 20% for SE and 52% for FC firms in 1986–1990. Therefore, sample firms might have different growth potentials in their oil and gas producing segments relative to other segments. The following information provides some evidence on this issue. The growth proxy for the oil and gas producing segments of sample firms (SUCCESS) is defined as the ratio of “Net change in the standardized measure of discounted future net cash flows due to extension, discoveries and improved recoveries less related costs” divided by the sum of exploration plus development costs. During 1982–1985, the average SUCCESS score of SE firms is 82.4 cents per dollar, which is significantly smaller than the average FC SUCCESS score of 132 cents per dollar ($t=3.07$, $p<.01$). The corresponding figures for 1986–1990 are 63.3 cents per dollar for SE and 97.1 cents per dollar for FC firms ($t=3.52$, $p<.01$). This seems to indicate that SE firms were unable to recover their investment in exploration and development during the sample period. (See Picchi (1985) for similar findings during 1982–1984.) These results also suggest that FC firms' growth potentials are concentrated in their oil and gas producing segments while SE firms' growth opportunities lie in their nonexploration activities because the entitywide growth opportunities of SE and FC firms do not differ significantly.

Beta Risk. Collins and Kothari (1989) and Easton and Zmijewski (1989) provide evidence that ERCs are negatively related to beta risk. The proxy for risk used in this study is Value Line BETA. The mean SE BETA is significantly smaller than the mean FC BETA in both the subperiods (see table 1). In order to control for potential risk effects on ERCs, Value Line BETA is included as a covariate in empirical tests.

Earnings Predictability. Lipe (1990) provides evidence that earnings predictability (the inverse of the variance of unexpected earnings) is positively related to ERCs. The Value Line measure of earnings predictability (EPRED) is used as the proxy for earnings predictability. This Value Line measure is based on the variance of percentage changes in quarterly earnings and ranges between 100 (high predictability) and 5 (low predictability). The mean SE EPRED is 52 (44) during 1982–1985 (1986–1990), which is significantly greater than the mean FC EPRED of 31 (32), respectively, for the corresponding periods (see table 1). EPRED is also included in empirical tests as a covariate.

Summary of Differences Between SE and FC Firms and Research Design Considerations

It appears from the foregoing discussions that SE and FC sample firms differ in terms of risk and earnings predictability. These variables are included in empirical tests as covariates in order

⁸ Anthony and Ramesh (1992, footnote 7) suggest this variable as a proxy for growth expectations. Value Line makes quarterly forecasts of next year's capital expenditure. In this study, the Value Line forecast of next year's capital expenditure made just prior to the end of the current year is used to compute $E(\text{capX})$.

⁹ The second growth proxy is the $\text{INV}/\text{INV}_{t-1}$ ratio where INV_t is Value Line reported capital expenditure in year t (deflated by beginning of year market value of equity). Collins et al. (1992) use $\log(\text{Investment}/\text{Investment}_{t-1})$ as a proxy for growth and argue that, if this variable is large, then managers have “recently anticipated higher demand for their product in the future and, hence, higher expected earnings growth.” Descriptive statistics presented in table 1 indicate that the $\text{INV}/\text{INV}_{t-1}$ ratio is not significantly different between SE and FC firms during either sub-period.

to isolate SE/FC accounting method effects on ERCs. Exploration costs, as a percentage of total revenues, decline in the post-1986 period and consequently SE versus FC ERC differences are likely to be attenuated during that period. Empirical models are estimated separately for 1982–1985 and 1986–1990.¹⁰

II. Empirical Models and Test Results

Earnings Persistence Tests

Ramakrishnan and Thomas (1992), Easton and Zmijewski (1989) and others hypothesize that ERCs are increasing in persistence. In order to examine the relative earnings persistence of SE versus FC firms, the following model is estimated using pooled time-series cross-sectional data for the entire sample period. A positive and significant coefficient on the $TYPE_{iq} * UE_{iq}$ variable would be consistent with SE firms' earnings persistence being greater than those of FC firms. $TYPE_{iq}$ is 1(0) for SE(FC) firms. UE_{iq} is defined in equation (1). (T-statistics are reported in parentheses.)

$$UE_{iq} = -0.006 + 0.007 TYPE_{iq} - 0.091 UE_{i,q-4} + 0.194 TYPE_{iq} * UE_{i,q-4} + e_{iq} \quad (2)$$

(-1.371) (1.408) (-1.559) (0.883)

Adj $R^2 = .01$

These results indicate that SE earnings persistence is, on average, not significantly different from FC earnings persistence.¹¹ Equation (2) is also estimated for the 1982–1985 and the 1986–1990 periods separately. Results (not reported) indicate that the results do not change for this time period partition. This result does not appear to be consistent with the prediction that SE ERCs are greater than FC ERCs. If SE and FC earnings are equally persistent, then it would seem logically inconsistent to hypothesize FC earnings to be less value relevant than SE earnings. One way to reconcile this apparent contradiction is to note that the FC method, by deferring and amortizing dry hole costs, is likely causing an *impression* of persistence in the reported earnings stream. This form of persistence arises from the persistence of accounting accruals rather than any cash flow effects. Under this scenario, it is possible for FC earnings to be as persistent as SE earnings, but still less value-relevant than SE earnings. Ramakrishnan and Thomas (1992) show that ERCs increase in earnings persistence when persistence reflects real economic effects.

ERC Tests - Empirical Models

Consistent with Collins and Kothari (1989), Collins and DeAngelo (1990), Collins and Salatka (1993), and others, the following pooled time-series cross-sectional model is estimated

¹⁰ Sample SE and FC firms also differ in terms of firm size. The average SE firm SIZE (market value of equity plus book value of long term debt) is \$8.20 billion as compared to \$0.89 billion for FC firms in 1982–1985. The corresponding figures for 1986–1990 are \$13.9 billion and \$1.45 billion, respectively. However, firm SIZE is not included as a covariate in empirical tests because Dempsey (1989) shows that the size effect disappears with analyst following and the sample firms are all followed by analysts. Another potential confounding variable is the riskless interest rate. Collins and Kothari (1989) demonstrate that intertemporal variations in ERCs are correlated with changes in the riskless interest rate. However, short term and long term T-bill rates were not different between SE and FC earnings announcement months during either subperiod.

¹¹ Equation (2) is also estimated by replacing Value Line quarterly earnings forecast errors by Foster (1977) AR(1) model quarterly earnings forecast errors. Earnings used for parameter estimation are as reported by Value Line Investment Survey. This approach is consistent with the Easton and Zmijewski (1989) methodology for estimating earnings persistence from mechanical time-series models. The overall conclusions are again that SE and FC earnings persistence do not significantly differ from one another during the sample period.

for the sample observations to test the hypothesized accounting method effect on ERCs and control for potential nonaccounting variables' influence on ERCs:

$$CAR_{iq} = a_0 + a_1 TYPE_{iq} + b_1 UE_{iq} + b_2 TYPE_{iq} * UE_{iq} + c_1 BETA_{iq} * UE_{iq} + c_2 EPRED_{iq} * UE_{iq} + u_{iq} \quad (3)$$

where

CAR_{iq} = market adjusted cumulative abnormal returns over day 0 and day minus 1 relative to the earnings announcement date for firm i in quarter q .¹²

UE_{iq} = unexpected earnings of firm i for quarter q as defined in equation (1).

$BETA_{iq}$ = Value Line beta for firm i for quarter q .

$EPRED_{iq}$ = Value Line reported earnings predictability for firm i for quarter q .

$TYPE_{iq}$ = 1 if firm i follows SE method in quarter q .

= 0 if firm i follows FC method in quarter q .

u_{iq} = a random disturbance term distributed $N(0,1)$.

All covariates enter the model interactively with unexpected earnings. This approach is consistent with Easton and Zmijewski (1989), Collins and Kothari (1989) and more recently Freeman and Tse (1992, equation 5).

In equation (3), the ERC for FC method ($TYPE_{iq} = 0$) is b_1 and that for SE method ($TYPE_{iq} = 1$) is $b_1 + b_2$, *after controlling for the covariates*. A positive value of b_2 is consistent with the prediction that, on average, the SE method is associated with larger ERCs relative to the FC method after controlling for covariate effects. Consistent with the evidence in Easton and Zmijewski (1989) and Collins and Kothari (1989), the coefficient on $BETA_{iq} * UE_{iq}$ in equation (3) is predicted to be negative. The coefficient on $EPRED_{iq} * UE_{iq}$ is predicted to be positive because earnings predictability is positively related to ERCs.

ERC Tests - Empirical Results

Results of estimating various versions of regression equation (3) are reported in table 2 (models 1 through 6). Models 1 and 2 in table 2 report results of regressing abnormal returns on unexpected earnings for the full 1982–1990 period. Model 1 includes the accounting method variable *without* controlling for covariates. The model exhibits significant heteroskedasticity (White's (1980) Chi-square = 32.87, $p < .01$). The coefficient associated with $TYPE_{iq} * UE_{iq}$ is 0.201 and significant (White's $t = 2.400$) at the $p < .01$ level.¹³ However, the potentially confounding effects of covariates on ERCs are not controlled for in this model. Model 2 includes the covariates. Consistent with the findings of Collins and Kothari (1989) and Easton and Zmijewski (1989), the coefficient on $BETA_{iq} * UE_{iq}$ is negative (-0.269) and significant at the $p < .01$ level (White's $t = -2.558$). The coefficient on $EPRED_{iq} * UE_{iq}$ is insignificantly different from zero ($t = -0.982$). The coefficient on $TYPE_{iq} * UE_{iq}$ is positive (0.251) and significant (White's $t = 2.265$) at the $p < .05$ level. This result is consistent with the hypothesis that the SE method is associated with larger ERCs as compared to the FC method, after controlling for potentially confounding covariate effects on ERCs.

¹² Earnings announcement dates are obtained from COMPUSTAT tapes and checked with reference to the Wall Street Journal Index.

¹³ T-statistics are calculated using White's (1980) heteroskedasticity consistent covariance matrix for models 1 through 6 because White's (1980) chi-square tests reject the null of homoskedasticity and model specification for all these models (see table 2). Significant assessments for the intercept terms and the $TYPE_{iq}$ terms are two-tailed. Significance assessments for all other variables are one-tailed.

Table 2
Summary Regression Results for Differential ERCs for SE vs. FC firms
(White's t-statistics in parentheses)

Variables	Predicted Sign	1982 - 1990		1982 - 1985		1986 - 1990	
		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	?	-0.005 (-2.050)**	-0.005 (-1.889)***	-0.006 (-1.830)***	-0.006 (-1.684)***	-0.002 (-0.571)	-0.004 (-1.062)
TYPE _{iq}	?	0.003 (0.961)	0.002 (0.777)	0.004 (1.041)	0.004 (0.934)	-0.001 (-0.223)	0.000 (0.038)
UE _{iq}	(+)	0.037 (1.150)	0.423 (3.492)*	0.045 (1.546)***	0.332 (2.754)*	-0.091 (-1.155)	0.585 (1.734)**
TYPE _{iq} *UE _{iq}	(+)	0.201 (2.400)*	0.251 (2.265)**	0.201 (2.171)**	0.284 (2.375)*	0.288 (1.648)**	0.062 (0.328)
BETA _{iq} *UE _{iq}	(-)	-	-0.269 (-2.558)*	-	-0.189 (-1.749)**	-	-0.629 (-2.673)*
EPRED _{iq} *UE _{iq}	(+)	-	-0.003 (-0.982)	-	-0.003 (-1.061)	-	0.007 (1.096)
Total (SE/FC) firm quarters of observation		870 (541/329)	870 (541/329)	470 (259/211)	470 (259/211)	400 (282/118)	400 (282/118)
Adjusted R ²		0.01	0.03	0.02	0.03	0.01	0.04
White's chi-square (df)		32.870* (5)	42.067* (16)	15.977* (5)	25.710* (16)	16.442* (5)	25.250** (15)
Maximum condition number		2.960	17.430	2.735	18.601	3.417	14.990

UE_{iq} = unexpected earnings firm i in quarter q, as defined in equation (1). TYPE_{iq} = one if the firm i uses Successful Efforts method of accounting in quarter q and zero if the firm uses Full Cost method of accounting. BETA_{iq} = Value Line beta for firm i in quarter q. EPRED_{iq} = Value Line reported earnings predictability for firm i for quarter q. The dependent variable is CAR_{iq}, market adjusted cumulative abnormal returns for day zero and day one relative to earnings announcement date. Significance levels (two tailed for the intercept term and the TYPE_{iq} variable and one-tailed for all other variables): * < 0.01, ** < 0.05, *** < 0.10. White's t-statistics are calculated using White's (1980) heteroskedasticity-consistent covariance matrix. White's chi-square is the test statistic derived by White (1980) to test the null hypothesis of homoscedasticity and model specification. Condition number measures the potential sensitivity of the solution vector b of the linear system Y = bX, to small changes in X and Y (see Belsley et al. 1980,

Models 3, 4, 5 and 6 report results of regressions estimated separately for 1982–1985 and 1986–1990, respectively. Note that the coefficients on the $TYPE_{iq} * UE_{iq}$ variables are positive (0.201 and 0.288) and significant (White's $t = 2.171$ and 1.648) in model 3 (1982–1985 period) and model 5 (1986–1990 period), respectively, at the $p < .05$ level. That is, the ERCs associated with SE firms are, on average, greater than those associated with FC firms when potentially confounding covariates' effects on ERCs are *not* controlled for in both subperiods. When covariates' effects on ERCs are controlled for in the regressions, the coefficient on $TYPE_{iq} * UE_{iq}$ in 1982–1985 is still positive (0.284) and significant (White's $t = 2.375$) at the $p < .01$ level in model 4. However, the coefficient on $TYPE_{iq} * UE_{iq}$ is not significant in 1986–1990 (coefficient estimate of 0.062 and White's $t = 0.328$) in model 6. These results are consistent with the notion that the significant SE versus FC ERC effects during 1982–1990 can be attributed to the earlier years in this period.¹⁴

The large condition numbers reported in table 2 indicate the potential existence of multicollinearity in the data. Since the variable of interest, $TYPE_{iq} * UE_{iq}$, has positive and significant coefficients in most models, the collinearity is not harmful.¹⁵

III. Tests of Alternative Explanations and Sensitivity Checks

Nonlinearities in the Earnings Response Function

An alternative explanation for the table 2 results is that SE and FC firms lie on the same nonlinear (S-shaped) earnings response function, but because FC firms have larger UEs they lie on the flatter portion of the curve (Freeman and Tse 1992). This implies that the TYPE variable might be proxying for nonlinearities in the earnings response function. One way to investigate this alternative explanation is to test for nonlinearities in the CAR-UE relation by estimating the parameters of the arctan ERC model examined by Freeman and Tse (1992). Accordingly, the following arctan model, without covariates, is estimated using pooled time-series cross-sectional data for 1982–1990:

$$CAR_{iq} = a_0 + a_1 \arctan(a_2 UE_{iq}) + v_{iq} \quad (4)$$

where CAR_{iq} and UE_{iq} have been defined earlier and v_{iq} is a random distribution term. Coefficients a_0 , a_1 and a_2 are estimated as $(-0.006; p < .01)$, $(0.005; p < .01)$ and $(213.189; p = .35)$, respectively.¹⁶ Since the magnitude of a_2 determines how equation (4) departs from linearity, the insignificant

¹⁴ The influence diagnostics procedures suggested by Belsley et al. (1980) (hereafter BKW) were used to identify influential observations in models 2 and 4 in which the $TYPE * UE$ variable has positive and statistically significant coefficients in table 2. Four observations in model 2 were identified which exceeded size-adjusted cutoffs for all the following BKW defined influence variables; RSTUDENT, hat diagonal (H), COVRATIO and DFFITS. To examine the robustness of the parameter estimates to potential outliers, model 2 was reestimated after deleting these four observations. The results did not change significantly. A similar procedure identified two potentially influential observations for model 4. Results for model 4 did not change significantly when these observations were dropped from the sample.

¹⁵ "... if an investigator is only interested in whether a given coefficient is significantly positive, and is able, even in presence of collinearity, to accept that hypothesis on the basis of the relevant 't' test, then collinearity has caused no problem." (Belsley et al. 1980, p. 116)

¹⁶ The Gauss-Newton iterative method (Green 1990) is used to estimate equation (4). Estimated coefficients are not sensitive to preselected initial values.

a_2 coefficient fails to support the nonlinear specification.¹⁷ Similar results apply for a_2 when equation (4) is estimated separately for SE and FC firms. The a_2 coefficients are estimated as (290.807; $p=.27$) for SE firms and (154.162; $p=.28$) for FC firms respectively.¹⁸

A different way to test for potential nonlinearities in the earnings response function is to introduce a cube-root transformation of the UE variable in equation (3). The cube-root function has an S-shape similar to that of the arctan function examined earlier. In particular, inferences are based on the results of estimating certain variants of the following regression model:

$$CAR = a_0 + a_1 TYPE_{iq} + a_2 UE_{iq} + a_3 TYPE_{iq} * UE_{iq} + a_4 UE_{iq}^{1/3} + a_5 TYPE_{iq} * UE_{iq}^{1/3} + w_{iq} \quad (5)$$

An insignificant $TYPE_{iq} * UE_{iq}^{1/3}$ variable and a positive $TYPE_{iq} * UE_{iq}$ variable in equation (5) would be consistent with the SE method being associated with larger ERCs than the FC method after controlling for potential nonlinearities in the earnings response model. Accordingly, the following two models are estimated using pooled time-series cross-sectional data for the entire sample period. (White's t-statistics are in parentheses.)

$$CAR = -0.008 + 0.005 TYPE_{iq} - 0.011 UE_{iq} + 0.154 TYPE_{iq} * UE_{iq} \\ (-2.617) \quad (1.469) \quad (-0.199) \quad (1.279) \\ + 0.025 UE_{iq}^{1/3} - 0.014 TYPE_{iq} * UE_{iq}^{1/3} \\ (1.617) \quad (-0.772) \quad (6)$$

Adjusted $R^2 = 0.02$.

$$CAR = -0.009 + 0.005 TYPE_{iq} + 0.236 UE_{iq} + 0.290 TYPE_{iq} * UE_{iq} \\ (-2.928) \quad (1.734) \quad (1.313) \quad (1.735) \\ + 0.084 UE_{iq}^{1/3} - 0.031 TYPE_{iq} * UE_{iq}^{1/3} - 0.151 BETA_{iq} * UE_{iq} \\ (1.989) \quad (-1.481) \quad (-1.099) \\ - 0.004 EPRED_{iq} * UE_{iq} - 0.033 BETA_{iq} * UE_{iq}^{1/3} - 0.000 EPRED_{iq} * UE_{iq}^{1/3} \\ (-1.421) \quad (-0.986) \quad (-0.415) \quad (7)$$

Adjusted $R^2 = 0.04$.

Equation (6) does not appear to be well specified because only the intercept term in the model is significant at the $p < .01$ level (White's $t=2.617$). The $UE_{iq}^{1/3}$ variable is marginally significant at the $p < .10$ level (White's $t=1.617$). Equation (6) does not control for covariates' effects, which is accomplished in equation (7). With covariates included, this model is better specified than

¹⁷Freeman and Tse (1992) show that for $|UE| > 0$ and $a_2 > 1$, an increase in a_2 causes a more than proportionate reduction in the ERC ($\delta CAR / \delta UE$ or $a_1 a_2 / (1 + a_2^2 UE^2)$) as $|UE|$ increases (the nonlinear effect). In contrast, a change in a_1 causes a proportionate change in the ERC. Thus, the degree of nonlinearity of equation (4) is determined by a_2 .

¹⁸An Approximate F test (Greene 1990, p.355) does not reject the null of equality of the regression coefficients (i.e., a_0 , a_1 and a_2) across SE and FC firms ($F(3,864)=1.61$).

equation (6). The adjusted R^2 is 0.04, which is twice that of equation (6). The $UE_{iq}^{1/3}$ variable is significant at the $p < .05$ level (White's $t = 1.989$), which is consistent with the presence of nonlinear effects in the earnings response model. The $TYPE_{iq} * UE_{iq}^{1/3}$ variable is only marginally significant at the $p < .10$ level (White's $t = -1.481$). This indicates that the extent of the nonlinearity does not differ significantly between SE and FC firms. The $TYPE_{iq} * UE_{iq}$ is positive (0.290) and significant at the $p < .05$ level (White's $t = 1.735$). These results tend to support the hypothesis that SE ERCs are larger than FC ERCs after nonlinear effects and covariates' effects have been controlled for in empirical tests. These results, *vis-a-vis* equation (6) results, also point to the importance of including covariates in nonlinear CAR-UE models. However, while the $TYPE_{iq} * UE_{iq}^{1/3}$ is marginally significant, its negative sign is troubling. The positive sign on the $TYPE_{iq} * UE_{iq}$ variable and a negative sign on the $TYPE_{iq} * UE_{iq}^{1/3}$ variable could imply that large values of UE would result in higher CARs for FC firms than for SE firms.

Sensitivity Tests

As discussed earlier (see section 1), the effect of SE/FC method choice on ERCs is likely to be less pronounced for firms with smaller values of the EXPL variable. To examine the robustness of the empirical results to variations in EXPL, equation (3) is estimated separately for firm quarters of observations for high and low values of EXPL (greater than and smaller than the median EXPL score) over the 1982–1990 period. Results (not reported in a table) indicate that the coefficient on $TYPE_{iq} * UE_{iq}$ is positive and significant for the high EXPL data partition (0.298; $p < .01$) and positive and marginally significant for the low EXPL data partition (0.214; $p < .10$). An F test does not reject the null of equality of the $TYPE_{iq} * UE_{iq}$ coefficients across the two EXPL partitions ($F(1,858) = 0.13$). This is problematic because the time period analysis is motivated by the hypothesis that changes in exploration activity influence the difference between SE and FC ERCs. The underlying notion is that EXPL is a better conditioning variable for ERC differences than time. However, this is not borne out by empirical evidence because shifts in ERC differences are more pronounced across time periods than across EXPL differences. Therefore, the change in exploration activity levels is possibly not the only factor driving the time period results, limiting the conclusion that it is the SE/FC choice driving the ERC differences documented earlier, rather than other operating characteristics.

Equation (3) is also estimated separately for “Integrated” firms and “Producers” as classified by Value Line. These two groups of firms face different markets and different production-investment opportunities. Results (not reported) show that the coefficient on the $TYPE_{iq} * UE_{iq}$ variable is positive and significant for “Integrated” firms (0.217; $p < .01$) and positive but insignificant for “Producer” firms (0.259; $p = .42$). However, the direction of the ERC differences (SE versus FC) between “Integrated” and “Producer” companies is as predicted because “Producers” tend to have larger EXPL scores (11% on average) than “Integrated” firms (3% on average), and because ERC differences are hypothesized to increase with intensity of exploration activity (EXPL). The insignificance of the $TYPE_{iq} * UE_{iq}$ variable for “Producers” potentially arises from the small number of observations, especially SE observations ($n(SE, FC) = 44, 167$) available for model estimation. Consequently, the power of tests associated with the “Producer” firm sample regression is likely to be low.

IV. Summary and Conclusions

The objective of this paper is to examine whether the market distinguishes between the SE and the FC method when it reacts to earnings announcements of oil and gas firms. The results continue a line of research which seeks to infer earnings quality by comparing ERCs across



alternative accounting methods. In this literature, a high quality earnings number is produced when valuation relevant events are incorporated in accounting earnings in the same fiscal period in which they are recognized in returns. Empirical predictions are based on Ramakrishnan and Thomas (1992) who argue that the FC method introduces significant amounts of price-irrelevant components in FC earnings. This is not the case with the SE method and thus, the SE method is predicted to be associated with larger ERCs than the FC method. Earnings response coefficients estimated from a sample of SE and FC firms during the 1982–1990 period support this hypothesis and the notion that SE accounting produces superior quality earnings than FC accounting. These results are consistent with the finding of Harris and Ohlson (1987) that SE firms exhibit larger market-to-book coefficients than FC firms. The results are also consistent with Ayres and Rayburn (1991) who regress annual returns on annual earnings changes and supplemental reserve based variables and find that the SE earnings change variable has larger coefficients than the FC earnings change variable.

One potential cause for concern in this paper is the sole reliance on Value Line earnings forecasts to draw inferences. However, empirical support for using Value Line analysts' earnings forecasts as the market's expectation of earnings appears in Brown et al. (1987a, 1987b). Also, while Value Line analysts' earnings forecasts exhibit an optimistic bias (Francis and Philbrick 1993), that bias is likely to be less than that of forecasts of analysts having links to investment banking services (Lin and McNichols 1991). Further, the staleness factor in Value Line forecasts is controlled for by including the LAG and RVL variables in empirical tests (see equation 1).

The main findings are sensitive to time-period partitions and to the effects of control variables. SE ERCs, on average, exceed FC ERCs during 1982–1985 but not during 1986–1990. The latter period is one of relatively low levels of exploration activity in the oil and gas industry. Differences across SE and FC accounting numbers are accentuated when exploration activity is high (such as during 1982–1985) because the SE/FC choice relates to how expenditures arising from production-investment decisions are reported. This time-sensitive result is consistent with Alciatore (1990) who concludes in her analysis of extant oil and gas research studies that market reaction to financial statement information has not been consistent over time.

The empirical results are robust to controlling for the effects of potentially confounding factors (exploration activity, growth, risk, earnings predictability and earnings persistence) that could differ between SE and FC firms and influence their ERCs. The inclusion of exploration activity (computed from SFAS No. 69 supplemental information) as a design variable addresses potential concerns that some supplemental reserve-based variables represent correlated and omitted variables in empirical tests. Of particular interest is the factor of persistence. On average, the persistence of reported earnings of SE and FC firms is the same, though their ERCs are not equal. This finding suggests that the market attaches no value to persistence created by accounting accruals per se.

References

- Alciatore, M. L. 1990. The reliability and relevance of reserve value accounting data: A review of the empirical research. *Journal of Accounting Literature* 9: 1–38.
- Anthony, J. H., and K. Ramesh. 1992. Association between accounting performance measures and stock prices: A test of the life cycle hypothesis. *Journal of Accounting and Economics* 15 (January): 203–228.
- Ayres, F. L., and J. D. Rayburn. 1991. Selectivity bias and the association between unexpected returns, earnings and supplementary reserve disclosures in the petroleum industry. Working paper, University of Oklahoma, Norman, OK and University of Minneapolis, MN.
- Belsley, D. A., E. Kuh, and R. E. Welsh. 1980. *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity*. New York, NY: Wiley.

- Brown, L., P. Griffin, R. Hagerman, and M. Zmijewski. 1987a. Security analyst superiority relative to univariate time-series models in forecasting quarterly earnings. *Journal of Accounting and Economics* 9 (April): 61–88.
- . 1987b. An evaluation of alternative proxies for the market's expectation of earnings. *Journal of Accounting and Economics* 9 (December): 159–194.
- Carroll, T., D. W. Collins, and W. B. Johnson. 1993. The Lifo-Fifo choice and the quality of earnings signals. Working paper, University of Iowa, Iowa City, IA.
- Collins, D. W., M. S. Rozeff, and W. K. Salatka. 1982. The SEC's rejection of SFAS No. 19: Tests of market price reversal. *The Accounting Review* 57 (January): 1–17.
- , and S. P. Kothari. 1989. An analysis of the intertemporal and cross-sectional determinants of earnings response coefficients. *Journal of Accounting and Economics* 11 (July): 143–181.
- , and L. DeAngelo. 1990. Accounting information and corporate governance: Market and analyst reaction to earnings of firms engaged in proxy contests. *Journal of Accounting and Economics* 12 (March): 213–247.
- , S. P. Kothari, J. Shanken, and R. G. Sloan. 1992. Lack of timeliness versus noise as explanations for the low contemporaneous returns-earnings association. Working paper, University of Rochester, Rochester, NY.
- , and W. K. Salatka. 1993. Noisy accounting earnings signals and earnings response coefficients: The case of foreign currency accounting. *Contemporary Accounting Research* 10 (Fall): 119–160.
- Deakin, Edward B. 1979. An analysis of differences between non-major oil firms using successful efforts and full cost methods. *The Accounting Review* 54 (October): 722–734.
- . 1989. Rational economic behavior and lobbying on accounting issues: Evidence from the oil and gas industry. *The Accounting Review* 64 (January): 137–151.
- Donelly, B. 1990. Profits' quality erodes, making them less reliable. *The Wall Street Journal* (October 18).
- Dempsey, S. J. 1989. Predisclosure information search incentives, analyst following and earnings announcement price response. *The Accounting Review* 64 (October): 748–757.
- Easton, P., and M. Zmijewski. 1989. Cross-sectional variation in the stock market response to the announcement of accounting earnings. *Journal of Accounting and Economics* 11 (July): 117–141.
- FASB (Financial Accounting Standards Board). 1977. *Financial Accounting and Reporting by Oil and Gas Companies: Exposure Draft*. Stamford, CT: FASB.
- . 1982. *Statement of Financial Accounting Standards No. 69: Disclosures About Oil and Gas Producing Activities*. Stamford, CT: FASB.
- Foster, G. 1977. Quarterly accounting: Time series properties and predictive ability results. *The Accounting Review* 52 (January): 1–21.
- Francis, J., and D. Philbrick. 1993. Analysts' decisions as products of a multi-task environment. *Journal of Accounting Research* 31 (Autumn): 216–231.
- Freeman, R. N., and S. Y. Tse. 1992. A nonlinear model of security price responses to unexpected earnings. *Journal of Accounting Research* 30 (Autumn): 185–209.
- Greene, W. H. 1990. *Econometric Analysis*. New York, NY: Macmillan.
- Harris, T., and J. Ohlson. 1987. Accounting disclosures and the market's valuation of oil and gas properties. *The Accounting Review* 62 (October): 651–670.
- Klingstedt, J. P. 1970. Effects of full costing in the petroleum industry. *Financial Analysts' Journal*. (September-October): 79–86.
- Lev, B. 1989. On the usefulness of earnings and earnings research: Lessons and directions from two decades of empirical research. *Journal of Accounting Research* 27 (Supplement): 153–201.
- Lilien, S., and V. Pastena. 1981. Intramethod comparability. The case of the oil and gas industry. *The Accounting Review* 56 (July): 690–703.
- Lin, H., and M. McNichols. 1991. Underwriting relationships and analysts' earnings forecasts. Working paper, Stanford University.
- Lipe, R. 1990. The relation between stock returns and accounting earnings given alternative information. *The Accounting Review* 65 (January): 49–71.
- O'Glove, T. L. 1987. *Quality of Earnings*. New York, NY: The Free Press.

- Picchi, B. 1985. *Structure of the US Oil Industry: Past and Future*. New York, NY. Salamon Brothers.
- Pincus, M., and C. Wasley. 1992. Voluntary accounting changes and earnings response coefficients. Working paper, Washington University, St. Louis, MO.
- Ramakrishnan, R. T. S., and J. K. Thomas. 1992. Valuation of permanent, transitory and price-irrelevant components of reported earnings. Working paper, Columbia University, New York, NY.
- Regulation S-X 210: 4-10. 1975. *Financial Accounting and Reporting for Oil and Gas Producing Activities Pursuant to the Federal Securities Laws and the Energy Policy and Conservation Act*. Washington, D.C. Government Printing Office: SEC.
- Securities and Exchange Commission. 1978a. *Accounting Series Release No. 257: Requirements for Financial Accounting and Reporting Practices for Oil and Gas Producing Activities*. Washington, D.C. Government Printing Office: SEC.
- . 1978b. *Accounting Series Release No. 258: Full Cost Accounting Practices*. Washington, D.C. Government Printing Office: SEC.
- . 1982. *Staff Accounting Bulletin No. 47 Interpretations Relating to Oil and Gas Accounting*. Washington, D.C. Government Printing Office: SEC.
- Spear, N.A. 1993. The stock market reaction to the reserve-based quantity disclosures of oil and gas producers. Working paper, The Flinders University of South Australia.
- Sunder, S. 1976. Properties of accounting numbers under full costing and successful efforts costing in the petroleum industry. *The Accounting Review* 51 (January): 1-18.
- White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48 (May): 817-838.

BOOK REVIEWS

James R. Boatsman, Editor

Editor's Note: Two copies of books for review should be sent to Dr. James Boatsman, School of Accountancy, Arizona State University, Tempe, AZ 85287-3606. The policy of the *Review* is to publish only those reviews solicited by the Book Review Editor. Unsolicited reviews will not be accepted.

YUJI IJIRI, *Creative and Innovative Approaches to the Science of Management*, The IC² Management and Management Science Series, Number 5 (Westport, CT: Quorum Books, 1993, pp. vi, 502)

Creative and Innovative Approaches to the Science of Management is a volume of 21 papers edited by Yuji Ijiri and dedicated to William Cooper on the occasion of his 75th birthday.

Thirty-five different scholars comprise the listing of authors and coauthors of the papers presented in a conference at Carnegie Mellon University. They include an impressive group of views from the field of management, both private and not-for-profit, accounting, information systems, finance, organization theory, economics and qualitative methods.

To an author, they are academics and include nine persons from faculties in Japan, Sweden, Peru and India. Only seven of the 35 are listed in Hasselback's 1993 edition of accounting department members although an additional five authors have contributed research and cited in the *Accounting Literature Index* (Fred Glover, Ferd Levy, Arie Lewin, Gerald Thompson and Andy Whinston).

All of them, as students or colleagues or intellectual disciples of Professor Cooper, share in the philosophy which has characterized the massive body of Cooper's research work pursued at Carnegie Mellon, then at Harvard University and now at the University of Texas. That approach has been one which views the "scientific manager" as one who acts both as a rational economic man and as an ethical professional committed to economic decision making and utilization of resources in the best interest of the entity served. In a word, the approach is summarized by "optimization," whether of profit, or of a social welfare function or for the dissemination of information for decision making. And generally it is optimization intended for application to problems of the "real world."

To some the collection of papers will appear to be dated in that there is scarcely a mention of one of the past decade's most popular paradigms of organization, i.e., the agent/principal theory. Others will approve of the generally normative and prescriptive nature of the collection; and given the complexity of society's and industry's problems, will find it especially timely.

The above generalization would be very misleading, though, if it failed to suggest the wide diversity of topics. Professor Ijiri has arranged the papers in seven categories, an effort made more difficult by the interdisciplinary tendencies of so many Carnegie Mellon graduates. In reverse order of their appearance, three papers deal with methodological issues: testing of contingency theories; the statistical technique, bootstrapping; and a reconciliation of multiple goal programming and negotiating. Three papers present straight forward maximization models with direct *Management Science* and/or *Decision Science* bloodlines. Three papers appear under the heading "Industry and Economy" including a Leontief-type multiregional model for India. Three deal explicitly with organizational design and three with various aspects of resource management. Four of the papers in the middle of the volume rely on the Data Envelopment Analysis (DEA) technique developed by Cooper, Charnes and Rhodes (1978) to measure the efficiency of decision makers in non-profit areas.

The two three-paper sections, of most direct relevance to *Accounting Review* readers are entitled "Computers and Decision Support" and "Accounting and Control." Information systems specialists will want to examine Hsu and Wallace's ambitious metadatabase representation, GIRD (global information

resources dictionary). A second MIS paper surveys decision support system of Japanese production control systems. The third MIS paper, by Bailey, Kiang, Kuipers and Whinston proposes an extension of analytical review procedures in auditing. The incorporation of qualitative reasoning in review simulation provides guidance to the expert when unexpected states are observed. (Warning! Not recommended for skimmers).

Finally in the "Accounting and Control" section, Rajiv Banker introduces a conceptual model on accounting for productivity gains and Ray Stephens assesses internal controls in one of the few papers not based on a formal model. In the lead article, Yuji Ijiri recaps some of the main ideas of his AAA monograph "Momentum Accounting and Triple Entry Bookkeeping"; applying the system to a hypothetical manufacturing firm. The third dimension of Ijiri's system focuses on the first time-derivatives of income flow accounts and provides managers with a running analysis of fluctuations in the rate of the firm's income. As relevant and promising as this theory appears to be, it does seem that the next step in its demonstration would be to use it to track a major corporation's income.

Only one aspect of the publication is regrettable. The occasion for the tribute, Professor Cooper's 75th birthday was in 1989. The volume appeared in 1993. Although bibliographical compendia are provided for each paper, references are to research appearing before 1989. Five years later, today's reader, who may not be intimately involved in each topic, has no way of knowing subsequent work in the topic.

In every other respect, this is a remarkable tribute to one of the most distinguished scholars of the last forty years. Professor Ijiri's labor of respect and admiration has produced a collection of the highest quality and those who believe in the benefits of normative modeling should add this volume to their collections.

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JOSEPH S. JOHNSTON, JR. and RICHARD J. EDELSTEIN, *Beyond Borders: Profiles in International Education* (Washington, DC: Association of American Colleges, 1993, pp. v, 78, \$20 U.S., \$25 overseas).

This compact book is about internationalizing college curricula, with special emphasis on collaborations between schools of business and liberal arts. Publication was supported by a grant from KPMG Peat Marwick Foundation to the Association of American Colleges and the American Assembly of Collegiate Schools of Business, where the authors respectively serve in executive capacities. There are only three chapters: an introduction, a collection of fifteen short case studies, or "profiles," of successfully-implemented international programs at U.S. colleges and universities, and a brief synthesis of the profiles.

The first chapter provides economic and pedagogical rationales for internationalization, documents the minuscule role that internationalization plays in U.S. education, and identifies collaborative strategies for adding international dimensions to business studies. The message is that internationalization serves objectives inherent in a study of liberal arts as well as to create specific competencies that have a market value. As such, it is natural to expect that collaborative efforts between liberal arts and business school faculties can be mutually beneficial.

The third chapter synthesizes the 15 profiles and in particular, identifies critical success factors suggested by them. The 15 profiles themselves that comprise the second chapter span a wide range of academic institutions, approaches and objectives: small state colleges with extremely limited funds to ivy league universities; creating new courses to creating a new campus culture; awareness of global issues to functional competency in another culture. Two examples may help to illustrate the variety:

- To strategically reposition Ramapo College of New Jersey, its president led a program to add an international dimension to virtually all aspects of college life. Objectives were set and implemented in the areas of faculty development, curriculum development, program expansion (e.g., languages, international telecommunications), experiential learning and development of programmatic partnerships with other entities.

- A professor of economics at the University of Michigan is the principle instructor for an introductory course entitled "Global Interdependence." The course was originally conceived by a professor of Asian languages and cultures, and showcases outstanding lecturers from a broad range of academic disciplines. The course is organized into discrete units, and each unit is concluded with small group discussion sessions as a means for synthesis and integration of lectures and readings.

Beyond Borders is a highly readable and comprehensive overview of opportunities for integrating international issues in a business curriculum, and methods of implementation. But as we all know, the devil

is often in the details, and one must look to other sources of information for examining any option in depth. The apparent intent of the authors and the book's sponsors is to motivate both academics and administrators to do just that.

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OTTO B. MARTINSON, *Cost Accounting in the Service Industry: A Critical Assessment* (Montvale, N.J.: Institute of Management Accountants, 1994, pp. 124, \$25).

This book reports survey results about cost accounting practices in the service industry. The work is motivated by the lack of empirical information explaining how cost accounting practices are employed in service companies. Thus, on this one note alone, the book is a contribution to our understanding of cost management practices. The research project is designed to answer the following questions:

- What cost accounting practices are used to determine the cost of service output (if any)?
- What type of systems are used by service companies (e.g. job order, responsibility, process, ABC)?
- What cost information is being generated and how is it being used (e.g. responsibility reporting, determining cost of output, pricing)?
- How are costs tracked in the organization (e.g. cost allocation and aggregation methods)?
- How do service companies employ the concept of work in process (if at all)?
- How do service companies report service costs externally and internally (e.g. type of accounts used, reporting frequency and levels)?

The preliminary answers to these questions are provided by a survey of 51 service companies ranging from \$10 million to \$1 billion + in sales. The service sectors represented in the study include professional services (5 types), communications, financial, health care, public utilities, and transportation. The only minor omission would be the hospitality, gaming, and entertainment industries. Thus, the study captures a broad cross-section of the service environment. The author uses a judgment sampling approach aimed at sampling each of the ten sectors equally. Thus, the frequency distribution results may not apply cross-sectionally to the service industry as a whole if the proportion of actual firms (or their importance) occurs unequally across the sectors. For example, my guess is that the professional service sector (approx. 50% of the observations) is overweighed in this study in terms of this sector's size in the service economy.

The study does not indicate the position of the target respondents. This important omission makes it difficult to evaluate some of the survey results. For example, some of the survey questions could be easily misunderstood by naive respondents. One question asked the companies to indicate if costs were accumulated by cost centers, cost pools, or activity centers. I could see respondents having internal disagreement over the definition of these terms. In addition there are a few minor inconsistencies in the findings, leading one to be concerned about respondent (mis)interpretation of some of the questions.

The general findings of the study suggest that most service firms use cost information for responsibility reporting and budgeting. A minority (39%) of firms use cost information to determine the cost of outputs. A majority of firms allocate costs to cost objectives. Job order costing is the most frequently cited accounting system used by the respondent companies. Over 50% of the firms do not account for work in process. Activity-based costing is not presently widely adopted in service firms.

The author calls for a classification structure for the service industry "... as a ...foundation for conducting accounting research, for developing management accounting practices, and for carry out meaningful studies and analyses of the service industry" (p. 78). Although this book does not formally provide such a classification structure, a close reading of the results does indicate at least one important stratification. Namely, project oriented service firms (accounting/legal, marketing, software and systems integration, architectural/engineering, and research/development) appear to have different operating, control, and accounting issues than do the other service sectors. Although this distinction is not formally developed in the study, the data from the tables seem to support this observation.

The book is very well written and is accessible to either the academic or practitioner. Overall, this book would be useful to researchers and teachers in cost management. In addition, there are informative nuggets throughout the book that would be useful supplements to any management accounting course.

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BOOKS RECEIVED FEBRUARY 16, 1994 TO MAY 16, 1994

- ADRIANE G. BERG, *Making Up for Lost Time: Speed Investing for a Secure Future* (New York: William Morrow and Company, Inc., 1994, pp. 271, \$22.00).
- W.P. BIRKETT, *Competency Based Standards for Professional Accountants in Australia and New Zealand* (Melbourne Victoria, Australia: Australian Society of CPAs, 1993, pp. xvi, 529).
- ROBERT BLOOM, H.G. HEYMANN, JAYNE FUGLISTER, and MARILYNN COLLINS, *The Schism in Accounting* (Westport, CT: Quorum Books, 1994, pp. x, 152, \$49.95).
- MICHAEL BROMWICH and ALNOOR BHIMANI, *Management Accounting: Pathways to Progress* (London: The Chartered Institute of Management Accountants, 1994, pp. x, 281, £12.95).
- ANTHONY CAREY, *Depreciation: The Time for Change* (London: The Institute of Chartered Accountants, 1993, pp. 116, £10.00).
- S. CHAN, M. GOVINDAN, E. LESCHIUTTA, J.Y. PICARD, G.S. TAKACH, and B. WRIGHT, *EDI for Managers and Auditors*, 2d ed. (Toronto: The Canadian Institute of Chartered Accountants, 1994, pp. x, 200, C\$39.50).
- THE CHARTERED INSTITUTE OF MANAGEMENT ACCOUNTANTS, *Performance Measurement in the Manufacturing Sector* (London: CIMA Publishing, 1993, pp. 58, £14.95).
- COOPERS & LYBRAND INTERNATIONAL TAX NETWORK, *1994 International Tax Summaries* (New York: John Wiley & Sons, Inc., 1994, pp. ix, 1,100, \$105.00).
- ROBERT EISNER, *The Misunderstood Economy: What Counts and How to Count It* (Boston: Harvard Business School Press, 1994, pp. xv, 222, \$22.95).
- JOHN H. ENGSTROM and LEON E. HAY, *Essentials of Governmental Accounting for Public Administrators* (Burr Ridge, IL: Richard D. Irwin, Inc., 1994, pp. xiii, 301).
- ADRIAN FURNHAM and BARRIE GUNTER, *Corporate Assessment: Auditing a Company's Personality* (New York: Routledge, 1994, pp. xiii, 293, \$29.95).
- PAUL GORDON and PAULINE WEETMAN, eds., *Orchestra plc Annual Report* (Edinburgh: The Institute of Chartered Accountants of Scotland, 1993, pp. x, 60, £10.00).
- DAN M. GUY, DOUGLAS CARMICHAEL, and O. RAY WHITTINGTON, *Audit Sampling*, 3rd ed. (New York: John Wiley & Sons, Inc., 1994, pp. xiii, 254, \$52.95).
- ANDREW A. HARIED, LEROY F. IMDIEKE, and RALPH E. SMITH, *Advanced Accounting*, 6th ed. (New York: John Wiley & Sons, Inc., 1994, pp. xxvi, 1,011).
- MARGARET HOSKINS, *Mary E. Murphy's Contributions to Accountancy* (New York: Garland Publishing, Inc., 1994, pp. ix, 374, \$63.00).
- JOSEPH S. JOHNSTON, Jr. and RICHARD J. EDELSTEIN, *Beyond Borders* (Washington, DC: Association of American Colleges, 1993, pp. v, 78, \$20.00).
- DONALD E. KIESO and JERRY J. WEYGANDT, *Intermediate Accounting 7th ed.* (New York: John Wiley & Sons, Inc., 1994, pp. xxv, 1,459).
- PETER H. KNUTSON, *Financial Reporting in the 1990s and Beyond* (Charlottesville, VA: Association for Investment Management Research, 1993, pp. viii, 97).
- STUART MacDONALD, *Making Corporate Reports Valuable* (Edinburgh: The Institute of Chartered Accountants of Scotland, 1993, pp. xii, 65, £10.00).
- DON F. MacLEAN, *Guide for Developing Quality Control Systems in Public Accounting* (Toronto: The Canadian Institute of Chartered Accountants, 1994, pp. xii, 177, C\$32.50).
- KIM MARINO, *Best Resumes for Accountants and Financial Professionals* (New York: John Wiley & Sons, Inc., 1994, pp. vii, 199).
- OTTO B. MARTINSON, *Cost Accounting in the Service Industry* (Montvale, NJ: Institute of Management Accountants, 1994, pp. xv, 124, \$25.00).
- ROBERT K. MAUTZ, *Financial Reporting for Nonprofit Organizations: A Fresh Look* (New York: Garland Publishing, Inc., 1994, pp. xii, 119, \$35.00).
- GRANT W. NEWTON, *Bankruptcy and Insolvency Accounting, 5th ed., 2 Volume Set* (New York: John Wiley & Sons, Inc., 1994, pp. xv, 843 [Volume 1], xviii, 663 [Volume 2], \$225.00).
- RAYMOND H. PETERSON, *Accounting for Fixed Assets* (New York: John Wiley & Sons, Inc., 1994, pp. xix, 199, \$55.00).

STEPHEN M. POLLAN and MARK LEVINE, *The Total Negotiator* (New York: Avon Books, 1994, pp. ix, 300, \$10.00).

LAWRENCE A. PONEMON and DAVID R. L. GABHART, *Ethical Reasoning in Accounting and Auditing* (Vancouver: CGA-Canada Research Foundation, 1993, pp. xvi, 148, C\$14.00).

NEIL SHEFLIN, *Tax and Financial Statement Benchmarks—1994* (New York: John Wiley & Sons, Inc., 1994, \$125.00).

GORDON V. SMITH and RUSSELL L. PARR, *Valuation of Intellectual Property and Intangible Assets*, 2nd ed. (New York: John Wiley & Sons, Inc., 1994, pp. xxvi, 515, \$125.00).

DONALD H. TAYLOR and G. WILLIAM GLEZEN, *Auditing: Integrated Concepts and Procedures*, 6th ed. (New York: John Wiley & Sons, Inc., 1994, pp. xxxii, 1,023, \$72.95).

JERRY J. WEYGANDT, DONALD E. KIESO, and WALTER G. KELL, *Accounting Principles*, 3rd ed. (New York: John Wiley & Sons, Inc., 1993, pp. xxxvi, 1,155).

JOHN C. WISDOM, *Checklists and Operating Forms for Small Businesses* (New York: John Wiley & Sons, Inc., 1994, pp. 565, \$95.00).

EDITORIAL POLICY AND STYLE INFORMATION

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According to the policies set by the Publications Committee (which were endorsed by the Executive Committee and were published in the *Accounting Education News*, June 1987), *The Accounting Review* "should be viewed as the premier journal for publishing articles reporting the results of accounting research and explaining and illustrating related research methodology. The scope of acceptable articles should embrace any research methodology and any accounting-related subject, as long as the articles meet the standards established for publication in the journal. . . . No special sections should be necessary. The primary, but not exclusive, audience should be—as it is now—academicians, graduate students, and others interested in accounting research."

The primary criterion for publication in *The Accounting Review* is the significance of the contribution an article makes to the literature.

The efficiency and effectiveness of the editorial review process is critically dependent upon the actions of both authors submitting papers and the reviewers. Authors accept the responsibility of preparing research papers at a level suitable for evaluation by independent reviewers. Such preparation, therefore, should include subjecting the manuscript to critique by colleagues and others and revising it accordingly prior to submission. The review process is not to be used as a means of obtaining feedback at early stages of developing the research.

Reviewers and associate editors are responsible for providing critically constructive and prompt evaluations of submitted research papers based on the significance of their contribution and on the rigor of analysis and presentation. Associate editors also make editorial recommendations to the editor.

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The Accounting Review's manuscript preparation guidelines follow (with a slight modification) the B-format of the *Chicago Manual of Style* (13th ed.; University of Chicago Press). Another helpful guide to usage and style is *The Elements of Style*, by William Strunk, Jr., and E. B. White (Macmillan). Spelling follows Webster's International Dictionary.

FORMAT

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2. Manuscripts should be as concise as the subject and research method permit, generally not to exceed 7,000 words.
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An Abstract of about 100 words should be presented on a separate page immediately preceding the text. The Abstract should concisely inform the reader of the manuscript's topic, its methods and its findings. The text of the paper should start with a section labeled "I. Introduction," which provides more details about the paper's purpose, motivation, methodology and findings. Both the abstract and the introduction should be relatively non-technical, yet clear enough for an informed reader to understand the manuscript's contribution. The manuscript's title, but neither the author's name nor other identification designations, should appear on the Abstract page.

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The author should note the following general requirements:

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works by the same author(s) in the same year are distinguished by letters after the date.

6. Inclusive page numbers are treated as recommended in *Chicago Manual* section 8.67.

Sample entries are as follows:

- American Accounting Association, Committee on Concepts and Standards for External Financial Reports. 1977. *Statement on Accounting Theory and Theory Acceptance*. Sarasota, FL: AAA.
- Demski, J. S., and D. E. M. Sappington. 1989. Hierarchical structure and responsibility accounting. *Journal of Accounting Research* 27 (Spring): 40–58.
- Dye, R., B. Balachandran, and R. Magee. 1989. Contingent fees for audit firms. Working paper. Northwestern University, Evanston, IL.
- Fabozzi, F., and I. Pollack, eds. 1987. *The Handbook of Fixed Income Securities*. 2d ed. Homewood, IL: Dow Jones-Irwin.
- Kahneman, D., P. Slovic, and A. Tversky, eds. 1982. *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge, United Kingdom: Cambridge University Press.
- Porcano, T. M. 1984a. Distributive justice and tax policy. *The Accounting Review* 59 (October): 619–36.
- . 1984b. The perceived effects of tax policy on corporate investment intentions. *The Journal of the American Taxation Association* 6 (Fall): 7–19.
- Shaw, W. H. 1985. Empirical evidence on the market impact of the safe harbor leasing law. Ph.D. dissertation, University of Texas, Austin.
- Sherman, T. M., ed. 1984. *Conceptual Framework for Financial Accounting*. Cambridge, MA: Harvard Business School.

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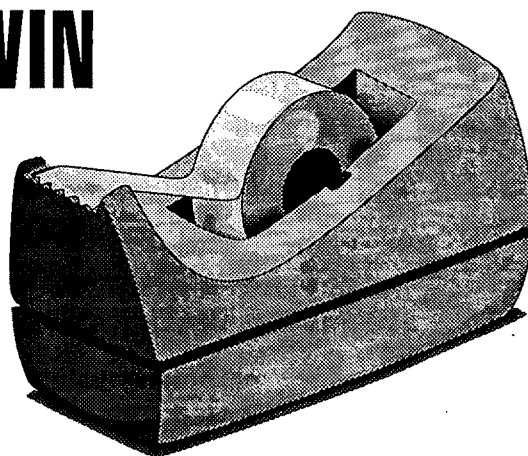
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